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CATALOG OF WAR GAMING AND MILITARY SIMULATION MODELS (7TH EDITI--ETC(U)

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CATALOG

OF

WAR GAMING

AND

ARY SIMULATION MODELS

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STUDIES, ANALYSIS, AND GAMING AGENCY
ORGANIZATION OF THE JOINT CHIEFS OF STAFF

CATALOG
OF
WAR GAMING AND MILITARY SIMULATION MODELS

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ABSTRACT

This catalog contains a brief description of 139 military simulations and models which are in general use throughout the Department of Defense. The models and simulations are categorized as to application. All models are listed alphabetically and are indexed by short title, long title, proponent, and developer. The description for each model includes: proponent, developer, purpose, general description, input, output, limitations, hardware, software, time requirements, security classification, frequency of use, users, and point of contact for additional information. The inclusion of a specific model in the catalog was at the discretion of its proponent, and thus does not in any way constitute indorsement of the model by the Organization of the Joint Chiefs of Staff.

FOREWORD

1. Purpose:

This catalog provides the Joint Staff, the Unified and Specified Commands, and the Services with information on a number of computer-based war gaming and military simulation models. This document identifies simulation models typically used by the Department of Defense to analyze problems involving strategic and general purpose force levels, their related logistics, postures and tactics, weapons systems effectiveness, and other comparisons/trade-offs.

It is hoped that this document will encourage and enhance the interpersonal exchange of model and gaming information, and increased communication and coordination between interested agencies. It is recognized that the models listed do not necessarily have universal application. The catalog can, however, greatly assist in eliminating significant duplication of effort, especially with respect to the acquisition or formulation and development of new models. This can normally be achieved by using the appropriate available model(s), with little or no modifications.

2. Scope:

This catalog is limited to models in current use within the Defense establishment. It does not provide a detailed nor exhaustive listing and description of all available models. Additions and deletions made relative to the sixth edition of this catalog were principally based upon the criterion of usage. This eliminated models of limited utility for current studies, and included those recently developed/modified and in general use by DOD agencies. Incomplete models and those in development were carefully evaluated before inclusion. Emphasis was placed upon well-documented models. In those instances where a particular model's application prospects were extremely limited, it was considered for deletion. Similarly, utility programs or routines used solely for information retrieval and pure mathematical calculations were normally not included. Models which were essentially the same but known by various names were entered once. Although these criteria were generally adhered to in determining the final disposition of all models, the judgments of the proponent agencies were considered to be most important.

3. Method:

Model descriptions have been expanded substantially from previous editions. The format was standardized to be of greater assistance to the analytic community. This feature should reduce the time expended in initial research, and provide a basis for rudimentary model comparison and evaluation relative to the application being considered.

This catalog uses the standard data collection sheet shown in Appendix E. Each organization contributing to this catalog identified those models it desired to have included and provided the supporting data. All models are listed alphabetically, and are indexed by short and long title.

4. Comment:

The seventh edition of the catalog contains about the same number of the models listed in the sixth edition. Each organization determined its own input; and thus, the omission of any model is the result of each organization's own decision.

As a consequence of changing model requirements, SAGA requests the aid of model developers and users in maintaining the catalog as current as possible. Accordingly, your assistance is solicited in providing information on all new model developments and capabilities, modifications to existing models, and deletions of obsolete models. This information should be forwarded in the format of the data collection sheet noted earlier to:

Organization of the Joint Chiefs of Staff
Studies, Analysis, and Gaming Agency
Systems Management and Information Officer
The Pentagon, Room 1D928
Washington, D. C. 20301

Based on the quantity of changes and additions received, addenda and/or complete revisions will be published periodically.

ALPHABETICAL INDEX OF MODELS BY SHORT TITLE

TITLE: AEM Hedge - Arsenal Exchange Model

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: AEM Hedge is a computerized, analytical general war model that provides a capability for quantifying strategic force analyses and allows hedging against uncertainty. The AEM model can simulate two world powers with three components: strategic forces (ICBMs, SLBMs, and bombers), non-retaliatory military resources, and non-military resources. In addition, a third power can be considered which has no retaliatory forces but may be targeted by one power having strategic forces. Area and terminal defenses of several types, with or without leakage, may be possessed by either or both sides.

An exchange may be initiated by either side. Each side may possess a variety of simultaneous objectives (which may or may not be shared or known by the opponent), including hedges against parametric uncertainties and catastrophic failures. The exchanges are sequential with the last strikes (if at least two strikes are performed), including the non-military resources. Several pure counterforce exchanges may precede the last two strikes. The effects of misestimating parametric values may be evaluated following an exchange.

GENERAL DESCRIPTION: AEM Hedge is a two-sided, deterministic model involving land, air and sea forces. Simulated time is treated on an event store basis. The primary solution techniques used are LaGrange multipliers, linear programming, mixed-integer programming, game theory and probability.

INPUT:

- o Scenario variables
- o Weapon variables
- o Target variables
- o Weapon and target hedge variables
- o Forward defense variables
- o Area defense variables
- o Budget optimization parameters
- o Optimum terminal defense deployment vehicles
- o Allocation constraints
- o Multi-goal objectives

OUTPUT:

- o Summaries in terms of the weapon allocation and value destroyed
- o Extensive summary of input data
- o Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- o Geography is not explicitly considered.
- o SAM and ABM defenses are highly aggregated representations.

HARDWARE:

- o Computer: IBM 360/50, IBM 360-65, CDC 6400, GE 635, UNIVAC 1108/1110, Honeywell 6000, IBM 370
- o Operating System: OS Release 20 (IBM); SCOPE (CDC)
- o Minimum Storage Required: 375K bytes
- o Peripheral Equipment: Standard scratch disk plus permanent disk for war file

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision. Documentation is updated periodically. A formal training program, both in model usage and methodology, exist.

TIME REQUIREMENTS:

- o 1 day to acquire and structure base data in model input format
- o 10-30 seconds CPU time per model cycle for one-strike allocation; 1 to 10 minutes for two-strike scenario
- o 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times a year

USERS:

- o Principal: OASD(PA&E)
- o Other: ACDA, Army CAA, USAF(SA), AFSC(FID), BMDSCOM

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D.C. 20301
Telephone: OX-55587

MISCELLANEOUS:

- o It is currently planned to expand the model's general capabilities for strategic analysis, including new scenarios.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic; Event Store; Linear Programming

TITLE: AESOPS

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: USAMSAA and Falcon Research and Development Company

PURPOSE: AESOPS is a computerized, analytic, sustained operations model that simulates the continuous operations of a company-sized helicopter unit over a period of several days of combat and introduces the impact of routine maintenance and combat damage repair on helicopter availability during such operations. The model combines the reliability, availability, and maintainability characteristics and combat damage repair or a helicopter type with the continuous operations of a helicopter unit in several days of combat. Secondarily, the model addresses the operational readiness of a helicopter unit in sustained combat. It can be used to analyze what factors influence the dynamic operational readiness of helicopters in combat and to what degree these factors influence helicopter readiness.

GENERAL DESCRIPTION: AESOPS is a two-sided, deterministic model involving air forces. It is designed to consider helicopter company sized units of any size. Simulated time is treated on a time step basis. Solution techniques include probability theory and queuing theory which are used in an expected values approach.

INPUT:

- Number of helicopters required for mission
- Time (a) from receipt of mission request to take-off; (b) to fly to target; (c) between target attacks; (d) between mission requests
- Reliabilities (a) startup; (b) mission leg; (c) return leg
- Mission dependent probabilities for various helicopter damage states (obtained from EVADE III)
- Repair times for each degree of helicopter combat damage and routine maintenance
- Number of targets defeated on the mission

OUTPUT:

- Computer printout showing number of helicopters lost
- Targets defeated
- Number of mission accepted over time period of interest
- Number of helicopters: under repair, awaiting repair, in flight; operationally ready
- Attrition for any time interval of simulation is an optional feature

MODEL LIMITATIONS:

- Expected Value Model
- Model can handle only one type of helicopter at a time
- Does not generate its own damage state probabilities
- Inputs are presently obtained from EVADE II

HARDWARE:

- Type of Computer: CDC 6600 and BRLESC
- Operating System: SCOPE 3.4, BRLESC
- Minimum Storage Required: 32K
- Peripheral Equipment: Calcomp plotter

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Not complete

TIME REQUIREMENTS:

- o One man-month required to acquire data base
- o One man-month to structure data in model input format

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 15 times per year

USERS: Principal: USAMSAA
Other: Falcon Research and Development Company

POINT OF CONTACT: Commander, USAMSAA
ATTN: DRXSY-AAS (Mr. Dinsmore)
Aberdeen Proving Ground, MD 21005
Phone: AV 283-4643

MISCELLANEOUS:

- o Model linked to EVADE II
- o Uses survivability results in form of probabilities of kill as input

KEYWORD LISTING: Analysis; Sustained Operations; Air; Computerized, Two-sided; Deterministic; and Time Step.

TITLE: AFSM - Artillery Force Simulation Model

PROPONENT: US Army Materiel Development and Readiness Command (DARCOM)

DEVELOPER: US Army Materiel Systems Analysis Activity (USAMSAA)

PURPOSE: AFSM is a computerized, analytic, damage assessment/weapons effectiveness model. AFSM is a basic force structure model that simulates an artillery battle between a Blue division, with its appropriate artillery, and a Red attacking army. It is used to determine the most effective of several competing artillery weapon/ammo force mixes in support of a "type" division. The model also keeps track of losses due to attrition and reliability and gains from float and the logistical repair system.

GENERAL DESCRIPTION: AFSM is a two-sided, deterministic model involving land forces. It was designed to aggregate Blue battalion (Red targets can be any size down to platoon) with a possible manipulation of Blue being examined at battery level). It is an event stored model. Queuing theory and probability are the primary solution techniques used.

INPUT:

- o Target scenario - description of potential targets for Blue artillery in the Red threat
- o Blue and Red artillery weapons systems characteristics (ranges, delivery errors, firing rates, etc.)
- o Blue and Red artillery rounds characteristics (lethal areas, etc.)
- o Blue and Red movement schedules and tactical rules that reflect Blue employment techniques

OUTPUT:

- o Red losses to Blue artillery (MOEs such as personnel losses, tanks destroyed, etc.)
- o Blue measures of effort such as rounds fired, battalion fire missions and Blue losses

MODEL LIMITATIONS:

- o Not dynamic
- o Red attack follows same time order no matter what losses Blue inflicts on Red

HARDWARE:

- o Computer: Digital
- o Operating System: Can be run on any with modification
- o Minimum Storage Required: 160K
- o Peripheral Equipment: Line printer, tape drive

SOFTWARE:

- o Programming Language: FORTRAN IV
- o No documentation at present

TIME REQUIREMENTS:

- o Months required depends on weapons in scenario
- o Two man-months to structure data in model input format
- o 20 to 90 minutes, depending on scenario for CPU time
- o CPU time per model cycle is 2/3 of run time
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Greater than 50 times a year

USERS:

- o Principal: US Army Materiel Systems Analysis Activity
- o Other: Fort Sill, TRANSANA

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-GS
Aberdeen Proving Ground, Maryland 21005
Phone: Autovon 283-4704/283-3508
(Robert Chandler)

MISCELLANEOUS:

- o Model is linked to Target Acquisition Model (TAM)
- o AFSM use TAM-generated target lists
- o Model supersedes Legal Mix IV

KEYWORD LISTING: Analysis, Damage Assessment/Weapons Effectiveness; Land Forces; Computerized; Two-sided; Deterministic; Event Store

TITLE: Aircraft Loader Model

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Institute for Defense Analyses (IDA)

PURPOSE: The Aircraft Loader Model is a computerized, analytical logistics model designed to simulate aircraft loading and thereby to assist in estimating the number of airlift aircraft required to perform a stated transport mission. The model can be used in planning transport aircraft operations, in comparing numbers of aircraft loads (sorties) required for different aircraft types, and in studying alternative aircraft cargo compartment configurations.

GENERAL DESCRIPTION: The Aircraft Loader Model is a deterministic model involving air forces only. Aircraft are considered individually, in sequence. Requirements may be considered individually or else they may be grouped. Numerical analysis is the primary solution technique used.

INPUT:

- o Weight allowable cabin load (WACL) for the aircraft type for the range or radius of operation
- o Length, width and height of cargo-carrying space
- o Number of passenger seats on the aircraft
- o Allowable stacking height of bulk cargo
- o Vehicle lists, including all self-propelled vehicles, weapons, prime movers, and towed loads to be loaded (detailed data are code number, item description, and number of pieces, weight, length, width, and height of each piece).
- o Passenger list (number of passengers and unit weight)
- o Bulk list which includes all other cargo to be loaded (code number, item description, number of boxes or pieces, weight, and cube)

OUTPUT:

- o Statement of loadings for each aircraft by chalk number, consisting of a detailed listing for each aircraft of the vehicles, passengers, and bulk on each "loaded" aircraft (chalk number), the weight and floorspace of the vehicles and bulk cargo, item descriptions of these vehicle and bulk items, the number and weight of passengers loaded, and the remaining weight and floorspace of the aircraft which has not been used
- o When all loading has been completed, a summary of all sorties is printed showing:
  (1) Number of sorties required;
  (2) Vehicles, passengers, and bulk not loadable (for example, items which are too large, too heavy, or passengers for whom there are no seats on the aircraft);
  (3) Number, weight, and floorspace of vehicles loaded; weight and floorspace of bulk loaded;
  (4) Number of passengers loaded;
  (5) Total fleet weight, floorspace, and passenger seats that were available for loading.

MODEL LIMITATIONS:

- The Sortie Generator technique is not designed to produce optimal loadings in the sense that the number of sorties estimated is a minimum estimate.
- The problem of fleets of mixed aircraft types is not addressed; the routine handles a single aircraft type at a time.

HARDWARE:

- Computer: IBM 360/50; HIS 6080
- Operating System: OS/MVT for IBM; GCOS for HIS
- Minimum Storage Required: 180K bytes; 36K words;
- Peripheral Equipment: Magnetic tapes and/or disk

SOFTWARE:

- Programming Languages: COBOL and FORTRAN IV
- No documentation is available on the J-4 modified version, but the original version is covered in IDA/WSEG Research Paper P-100, "Aircraft Loading Considerations," January, 1964. Documentation is being updated.

TIME REQUIREMENTS:

- 1 month to acquire base data
- Little if any time to structure base data in model input format
- 10 minutes CPU time per model cycle
- 1 man-day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon
Washington, D. C. 20301
Telephone: OX7-5464

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Computerized; Deterministic

TITLE: Aircraft Station Keeping Model (GPSS Version)

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Systems Command (AIR-503)

PURPOSE: The GPSS version of the Aircraft Station Keeping Model is a computerized, analytical, logistics model that simulates operations of aircraft (such as CAP) which utilize a fixed schedule of launches and retrievals in maintaining a given number of stations. Steady-state (long term) and transient (short term) options are available. The model addresses the problem of backup estimation (that is, estimation of the number of failure prone aircraft that are required to maintain a fixed number of stations).

GENERAL DESCRIPTION: Aircraft Station Keeping Model is one-sided and stochastic, and involves air forces only. The model was designed to aggregate anywhere from 1 to 100 aircraft. Simulated time is treated on an event store basis. Discrete event simulation is the primary solution technique.

INPUT:

- o Number of aircraft, stations, repair facilities and turnaround facilities
- o Span of station occupancy per day
- o Aircraft station time
- o Transit time to station
- o Time effectively on station while on way to station
- o Minimum acceptable on-station time for unscheduled launches
- o Average time to in-flight abort
- o Turnaround time
- o Parameters for repair time distribution
- o Probabilities of down squawk, in-flight abort, and check-out failure after turnaround

OUTPUT:

- o Computer printout of the probability distribution of the number of aircraft on station and the average number on station
- o Daily statistics are output for the transient case.
- o A printout of the probability distribution of total time accumulated on station up to and including each day (for the transient case)
- o A plot of the above case
- o A printout of certain readiness statistics

MODEL LIMITATIONS:

- o Aircraft must be of a single type.
- o A schedule of launches and retrievals is set up by the model such that the span of station occupancy is divided into an equal number of shifts based on the station time supplied as an input.

HARDWARE:

- o Computer: CDC 6600
- o Operating System: NOS/BE 1.0
- o Minimum Storage Required: 110K octal words
- o Peripheral Equipment: Calcomp 565 plotter

SOFTWARE:

- o Programming Languages: GPSS V/6000, FORTRAN IV
- o Documentation: Basic ground rules for the model are the same as for a similar model described in Naval Air Systems Command Technical Memorandum, "Aircraft Station Keeping: A Computer Simulation Program for Backup Evaluation," Technical Memorandum No. TM-A-503-74-7, November 1974
- o User's documentation and technical documentation are incomplete.

TIME REQUIREMENTS:

- o Time required to acquire base data is variable.
- o Less than 1 man-month to structure data in model input format.
- o CPU time per model cycle is dependent upon inputs.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2-3 projects per year

USERS:

- o Principal: Naval Air Systems Command

POINT OF CONTACT: Naval Air Systems Command
Systems Analysis Division (AIR-503)
Washington, D. C. 20361
Telephone: Autovon 222-3447

MISCELLANEOUS: While the model does not supersede the non-GPSS version, it contains several additional options. The user is cautioned, however, that use of the GPSS language results in increased CPU time per model cycle.

KEYWORD LISTING: Computerized; Analytical; Logistics; One-Sided; Stochastic; Air Forces; Event Store

TITLE: AGM - Attack Generator Model

PROPONENT: Federal Preparedness Agency, General Services Administration (FPA/GSA)

DEVELOPER: Mathematics and Computation Laboratory, FPA/GSA

PURPOSE: The Attack Generator is a computerized, analytical model designed to provide a means of selecting the most effective use of a given enemy nuclear attack capability to attain specified objectives. The model assigns nuclear weapons to targets by target categories to maximize the expected contribution to the objectives. This capability assists in formulating potential enemy attacks in the study of nuclear weapons following a nuclear exchange and in devising nuclear attack patterns for sensitivity studies and exercises.

GENERAL DESCRIPTION: The Attack Generator is a one-sided, deterministic model involving air and nuclear forces. It can consider missiles and bombers on an individual basis if so desired and can aggregate up to the worldwide level. The primary solution techniques employed are probability and queuing theory.

INPUT:

- Weapon detonation information such as yield, height of burst, probability of arrival and circular error probable is provided with the weapon inventory.
- The necessary input pertaining to resources in potential target categories includes their location, characterization of physical vulnerability and relative measures of target value. For area targets, such as population and broad classes of industry, a system of target value aggregation is required to define the target for weapon assignment. The size should provide maximum aggregation within the limits of the expected effective weapons radius of the smallest weapon in the inventory.

OUTPUT:

- A weapons list on magnetic tape suitable as input for such models as READY and RISK II described elsewhere in this publication. The list includes weapon identification information, coordinates of the desired ground zero, and the aggregate pre-attack expected residual values for each target category. If desired, associated input information may be reported, such as detonation characteristics and the name of the target.

MODEL LIMITATIONS:

- The precision of results is subject to the same uncertainties as pertain to predictions of weapons effects and physical vulnerability in basic nuclear damage assessment routines.
- Potential targets which can be considered in one weapon application are limited to 4,000 in a single pass. Hence, consideration of a larger file requires consideration of the highest 4,000 in the first round with subsequent sequential runs for the remainder.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 64K
- o Peripheral Equipment: UNIVAC 9300 Card Reader and Printer, Honeywell Page Printing System

SOFTWARE:

- o Programming Language: FORTRAN V (1108)
- o Documentation: ATTACK I, Attack Pattern Generator, TR-27 Rev. 1, Office of Preparedness, GSA, October 1973

TIME REQUIREMENTS:

- o 1-2 weeks to structure the current base data in model input format for major studies
- o Approximately 1 to 2 hours' CPU time, depending on scope of study
- o Hours to days to analyze and evaluate results, depending on scope of study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Three major studies UNCLEX 73, HAZARD-74, PONAST

USER: Federal Preparedness Agency

POINT OF CONTACT: MCL/FPA - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory (EDM)
Federal Preparedness Agency, GS Building
Washington, D. C. 20405
Telephone: 566-0912

MISCELLANEOUS:

- o The Attack Generator Model provides input for the FPA Damage Estimation Models, READY and RISK II, in the form of a weapons input file on magnetic tape.

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; One-Sided; Deterministic; Allocation

TITLE: AGTM - Air and Ground Theatre Model

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: AGTM is a computer program simulating air and ground combat, nominally at the divisional level. The air component of the program is no longer in use at STC, and this description will be limited to the ground component. The model serves at STC as an off-the-shelf capability for the study of ground combat at theatre level.

GENERAL DESCRIPTION: AGTM is a deterministic, time stepping model based on the ground component of the ATLAS model. The model has been modified by the adoption of a more refined methodology for the calculation of attackers and defender's effectiveness. This method takes into account the composition of the opposing forces in addition to their relative strength. For each period of battle, the principal output from the model is the distance advanced by the attacker and the casualties suffered by both sides.

The model can be executed in three different modes of operation, namely game mode, simulation mode, and game/simulation mode. In game mode, orders are input by the user at the terminal when requested by the program. In simulation mode, contingency plans have to be prepared in the form of an order file before the start of the execution of the model: no user/program interaction occurs in this mode. Games/simulation is a combination of the two modes of operation already described.

INPUT:

- o Sector information (terrain, prepared defences)
- o Unit information (ICE-value as a matrix giving hard, medium, soft shooter's capability against hard, medium and soft targets)
- o Rate-of-advance table
- o Casualty curves
- o Orders (if simulation run)

OUTPUT: The output consists of an end-of-period summary at the terminal giving FEBA-position and force ratio per sector. More details, such as casualties and current index of firepower potential per unit, are printed on the line printer.

LIMITATIONS: In principle, there is no limit to the number of sectors and units which AGTM can handle, although the execution time is affected by the amount of data.

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.3 or 3.4 and, when used interactively, INTERCOM 4
- o Minimum Storage Requirement: 60_8 K words
- o Peripheral Equipment: Line printer - remote terminal

SOFTWARE:

- o Programming Language: SIMULA-67
- o Documentation: STC TM-403 "AGTM (An Air and Ground Theatre Model): User's Guide and Program Description," Jan 1974 (NU)

TIME REQUIREMENTS: Collection of the data base can be time consuming, but the preparation of the input cards should only take 1-3 weeks dependent on the number of sectors and units. Execution time: 5-10 CPU seconds/sector/time period.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not in regular use

USERS: STC with military participation

POINT OF CONTACT: SHAPE Technical Centre
P. O. Box 174
The Hague
Netherlands
APO New York 09159

KEYWORD LISTING: Simulation; Deterministic; Time Step; Ground Forces

TITLE: ALM - Airlift Loading Model

PROPONENT: United States Air Force, Studies and Analysis (USAF/SA)

DEVELOPER: United States Air Force, Studies and Analysis (USAF/SA)

PURPOSE: ALM is a computerized, analytical logistics model designed to simulate the loading of military vehicles into cargo aircraft in order to determine the number of sorties required to deploy a force of any size. In addition, the model determines the loadability of military vehicles through the aircraft door and in the cargo compartment.

GENERAL DESCRIPTION: ALM is a one-sided model involving land and air forces. It is designed to consider any level of military unit and any combination of military units. The widest vehicles are loaded first, starting at the left fore corner of the cargo compartment. The widest vehicle that fits the gap remaining is loaded next. Loading proceeds fore to aft in the cargo compartment.

INPUT:

- o Aircraft characteristics
- o Vehicle characteristics
- o Numbers of vehicles in each unit
- o Movement order of vehicles
- o Loading order of aircraft

OUTPUT:

- o Computer printout of loadability of vehicles
- o Vehicles sorted by their dimensions and weight
- o Individual loads and loading summaries

MODEL LIMITATIONS:

- o 1,000 vehicle types
- o 5 aircraft types

HARDWARE:

- o Computer: Honeywell 635, Multics
- o Operating System: GECOS
- o Minimum Storage Required: 60K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Users' and programmers' manuals are available in AF/SAA, SAGS

TIME REQUIREMENTS:

- o Time to acquire and structure base data in model input format varies, depending upon the number of units to be loaded.
- o Less than 5 minutes CPU time per model cycle, multiple cycles permissible.
- o 2-4 weeks learning time for users
- o Approximately 1 hour to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Bi-weekly

USERS: AF/SA Mobility Division (SAGS)

POINT OF CONTACT: Hq US Air Force
Assistant Chief of Staff/Studies and Analysis
Computer Applications Group
The Lynn Building
1111 19th Street
Arlington, VA 22209
Telephone: OX-48420

MISCELLANEOUS:

o ALM supersedes the SLAM (Simulating the Loading of Aircraft with Military Cargo) Model.

KEYWORD LISTING: Airlift Loading; Cargo Vehicles; Air Transportability

TITLE: AMMORATES - Ammunition Rates

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Combat Developments Command. Model(s) has evolved through several stages. The latest developments have been done in-house.

PURPOSE: A series of models (routines) used in combination to determine nonnuclear ammunition requirements through combat simulations.

GENERAL DESCRIPTION: The AMMORATES model (system) consists of nine individual models (routines). These are:

- o Blue Artillery Model (BAM)
- o Casualty Assessment Model (CAM)
- o Anti-Armor Helicopter Combat Model (HOVARM)
- o Anti-Personnel Helicopter Combat Model (HOVER)
- o Infantry Combat Model (ICM)
- o Red Artillery Model (RAM)
- o Target Acquisition Model (TAM)
- o Tank-Anti-Tank Simulation (TATS)
- o Theater Rates Model (TRM)

The focal model of the AMMORATES system is the TRM which simulates a theater conflict, generating stylized combat periods as a framework in which combat simulation models are applied, to compute ammunition consumption rates for the several weapon-munition combinations.

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGT)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: For detail, see descriptions of the individual models of the AMMORATES system.

- o BAM - Blue Artillery Model
- o CAM - Casulaty Assessment Model
- o HOVARM - Anti-Armor Helicopter Combat Model
- o HOVER - Anti-Personnel Helicopter Combat Model
- o ICB - Infantry Combat Model
- o RAM - Red Artillery Model
- o TAM - Target Acquisition Model
- o TATS - Tank-Anti-Tank Simulation
- o TRM - Theater Rates Model

KEYWORD LISTING: Analytical Model; General War (Non-Nuclear); Ammunition Requirements

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TITLE: AMPS - Air Movement Planning System

PROPONENT: U.S. Army Logistics Center

DEVELOPER: U.S. Army Logistics Center, Operations Analysis Directorate

PURPOSE: AMPS is a computerized, analytic, logistics model designed to plan, diagram and manifest individual aircraft loads of equipment and personnel for movement on C-5, C-141 and C-130 aircraft. The model develops optimum load plans to determine ability to accomplish a defined movement requirement.

GENERAL DESCRIPTION: AMPS is a deterministic model which can be used to plan movement of detachments through brigades. Specific characteristics, balance and safety constraints are considered in development of individual loads for each aircraft type.

INPUT:

- Cargo list
- Aircraft list

OUTPUT:

- Schematic load plans
- Manifests (cargo and passenger)

MODEL LIMITATIONS:

- Cargo examined by cube, weight and center of gravity only rather than by specific item characteristics such as axle location and vehicle overhang
- Vehicle tie down space determined on worst case basis rather than specifics

HARDWARE:

- Computer: IBM 360 or CDC 6400/6500
- Operating Systems: OS or DOS; SCOPE
- Minimum Storage Required: 96K
- Peripheral Equipment: One disk

SOFTWARE:

- Programming Language: COBOL
- Documentation: User's documentation available
Technical documentation under preparation

TIME REQUIREMENTS:

- 1 man-month to prepare data base
- 1 hour CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate
ATTN: ATCL-OCP (W. E. King)
Ft. Lee, Virginia 23801
Telephone: Autovon 687-4180/3403

MISCELLANEOUS: This model supersedes CAPS, Computerized Airlift Planning System and AAMS, Automated Air Movements System.

KEYWORD LISTING: Analytic; Logistics; Computerized; Aircraft Loading; Air Movement

TITLE: AMSWAG - Army Materiel Systems Analysis Activity Wargame

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: AMSWAG is a computerized, analytic, damage assessment/weapons effectiveness model which provides continuous (10-second interval) results of force-on-force (battalion versus company) engagements for the classical attack/defense situations. The model's chief focus of concern is weapon systems effectiveness within a force-on-force battle context. AMSWAG is also concerned with ammunition expenditures, expected time for one system attrit another, detection, accuracy and dispersion, vulnerability, mobility and existence of line-of-sight.

GENERAL DESCRIPTION: AMSWAG is a two-sided, deterministic model involving land forces only. The model considers individual weapon systems, with a range of possible manipulation to include homogeneous weapons at the squad level. The largest formation AMSWAG considers is platoon, with a range of possible manipulation to include battalion. Simulated time is treated on a time step basis. The ratio of Game Time to Real Time is .5. AMSWAG employs differential (Lanchester) equations probability theory as its primary solution technique.

INPUT:

- Scenario (terrain description, force composition and distribution, mobility, exposure, advance routes)
- Accuracy
- Dispersion
- Biases
- Size
- Vulnerability
- Ammunition
- Target priorities
- Acquisition characteristics
- Tactics
- Round choice
- Reload properties

OUTPUT:

- Computer printout stating expected outcome at 10-second intervals
- Victim-killer score boards
- Unit statuses
- Ammunition expenditures
- Vehicle exchange ratio
- Time
- Closing range
- Plots, detailed and summary results at 10- or 60-second interval

MODEL LIMITATIONS:

- No defender movement
- No air forces, battalion level, pre-selected routes, pre-processed line-of-sight, pre-selected attack halt positions.

HARDWARE:

- o Computer: BRLESC I and II
- o Operating System: BRLESC
- o Minimum Storage Required: 150K
- o Peripheral Equipment: 3 discs, tape drives, card reader, printer

SOFTWARE:

- o Programming Language: FORTRAN IV and Assembly
- o Documentation: AMSAA Technical Report No. 169 by Joe H. Hawkins (July 1976)
- o Technical documentation is not complete. Some documentation planned in the near future.

TIME REQUIREMENTS:

- o 3 months to acquire base data
- o .5 man-months to structure data in model input format
- o 10-20 minutes per case playing time
- o 70 percent of run time per model cycle
- o 5 months learning time for players
- o .5 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 300 times per year

USERS:

- o Principal: US Army Materiel Systems Analysis Activity - GWD - Special Projects Branch
- o Other: US Army Materiel Systems Analysis Activity - AWD, BRL-BMD

POINT OF CONTACT: Dr. Herb Fallin (DRXSY-GP)
US Army Materiel Systems Analysis Activity
Aberdeen Proving Ground, Maryland 21005

MISCELLANEOUS: This model is linked to TRACOM and supersedes Bonder/IUA.

KEYWORD LISTING: Computerized; Analytic; Damage Assessment/Weapons Effectiveness; Two-Sided; Deterministic; Time Step

TITLE: ANSR - Analysis of SAFEGUARD Repertoire

PROPONENT: U.S. Army Ballistic Missile Defense Program Office

DEVELOPER: Stanford Research Institute - Huntsville

PURPOSE: ANSR is a computerized analytical, damage assessment/weapons effectiveness model that determines the area coverage capability of the SAFEGUARD System or other midcourse intercept BMD system against either an ICBM or SLBM threat. The capability and flexibility of the program allows it to be used for the general study of effectiveness of BMD deployments having one or more batteries for area defense.

GENERAL DESCRIPTION: The model is two-sided, deterministic and was primarily designed to accommodate one battery, one target and one re-entry vehicle with a range of possible manipulation. The model was primarily designed for 12 search radars, 40 tracking radars, 30 interceptor farms, 350 ICBM or SLBM launch points, 215 target or impact points with a range of possible manipulation to include any combination of above. The ratio of game time to real time (for fully or partially manual models) is about 10 seconds of central processor time for each launch point-impact point combination.

INPUT:

- o Location and configuration of the defense radars.
- o The parameters of each radar, such as maximum instrumental range, minimum elevation angle, scan penalty, and minimum signal-to-noise ratio for detection.
- o The ballistic missile parameters, such as launch and impact points, re-entry vehicle and tank radar cross sections, and separation rate between the re-entry vehicle and tank.
- o Interceptor flyout curves and other interceptor data, such as minimum intercept altitude, and divert rate.
- o Miscellaneous information such as integration time interval, and various indicator flags.

OUTPUT: The output is a listing of important offense and defense parameters or conditions existing at some significant event or time during an engagement; for example, radar parameters and interceptor and re-entry vehicle locations at intercept time. ANSR is designed so that six different analyses may be performed: (1) determine single or multiple battery coverage for a specific target list against either an SLBM or ICBM attack; (2) computer battle space; (3) generate the periphery of a footprint given an initial impact point; (4) generate a footprint given a grid of impact points; (5) output offense trajectory profiles only; and (6) generate radar tracking data only.

MODEL LIMITATIONS:

- o Maximum of 12 search radars and 40 tracking radars each having from one to four phases array faces
- o Maximum of 30 interceptor farms with no more than two types of interceptors
- o Maximum of 350 ICBM or SLBM launch points
- o Maximum of 215 target or impact points

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.4
- o Minimum Storage Required: 100,000 Octal

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: No formal documentation available

TIME REQUIREMENTS:

- o Acquire base data: N/A
- o Structure data in model input format: N/A
- o CPU time per model cycle: Variable depending upon option
- o 0 to 2 months learning time for players
- o 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS: SRI and BMDSCOM

POINT OF CONTACT: J. O. Carroll, H. A. Lewis, J. L. Dyer, J. A. Harvilla
Stanford Research Institute
Huntsville, Alabama 35804
Telephone: 205/837-3050

MISCELLANEOUS: ANSR is linked to Submarine Launch Assignment, Targeting, and Effectiveness Models (SLATEM). ANSR is capable of generating a list of SAC bases that can be attacked by avoiding the defense from each SLBM launch point; this list is then input into SLATEM as possible launch points for use against SAC bases. It is not planned to add new capabilities to this model.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Computerized; Two-Sided; Deterministic; Time Step

TITLE: APAIR, Mod 2, 2.5, 2.6 - ASW Program Air Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: J. D. Kettelle Corporation

PURPOSE: APAIR is a computerized analytic model which simulates interaction between an enemy submarine and one aircraft permitting study of a complete engagement through attack, reattack and kill.

GENERAL DESCRIPTION: The model is two-sided, stochastic involving one aircraft vs one submarine; however, multiple runs can increase the number of platforms. Time is in time-step mode. The model accounted for addressees, weapons, fire control, sensors, platform noise and kinematics, environment, tactics and a user formulated scenario.

INPUT:

- o Sensor, weapon, fire control, platform and environment characteristics
- o Tactics
- o Scenario

OUTPUT:

- o Printout and plot of statistically derived quantities
- o Summary of replication history

MODEL LIMITATIONS:

- o One airplane vs one submarine
- o No countermeasures
- o No false targets

HARDWARE:

- o Computer: DCC 6400, 6600, 6700 and IBM 360
- o Minimum Storage Required: 100 to 250K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation SAOR 69-10 APAIR MOD 2, ASW Programs Air Engagement Model (U) Abstract (uncl) (AD 860 260L) Vol. 1, Part 1: User's Manual (uncl) (AD 860 261L) Vol. 1, Part 2: Sample Application (Conf) (AD 509 866L) Vol. 2, Part 1: Programmers Manual (Uncl) (AD 860 262L) Vol. 2, Part 2: Program Listing (Uncl) (AD 860 263L) SOATM 71-12 APAIR MOD 2.6 ASW Programs Air Engagement Model (U) Vol. 1: User's Manual (Uncl) (AD 890 139L), Vol. 2: Programmers Manual (Uncl) (ADB 006 017L)

TIME REQUIREMENTS:

- o Structure data base/man month
- o CPU time 30 seconds per replication

<u>SECURITY CLASSIFICATION</u>: UNCLASSIFIED

<u>FREQUENCY OF USE</u>: 45 times per year

<u>USERS</u>: Manager, ASW Systems Program
NAVAIRSYSCOM

<u>POINT OF CONTACT</u>: Manager, ASW Systems Project
Navy Department
Washington, D. C. 20360
Telephone: 202/692-9141

<u>KEYWORD LISTING</u>: Computerized; Analytic; ASW; Time-Step; Two-Sided

TITLE: APSUB MOD 2 - ASW Program Submarine Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: Naval Weapons Laboratory/MASWSP

PURPOSE: APSUB MOD 2 is a computerized, analytical, limited war model that has been used extensively for weapon studies and for pre and postexercise analysis and exercise design. The model is primarily concerned with studying the effectiveness of ASW missions, studying in detail the interaction between opposing vehicles, and determining optimum tactics and optimum use of sensors.

GENERAL DESCRIPTION: APSUB MOD 2 is a two-sided, stochastic model involving sea forces only. It is capable of considering submarine encounters on a one-to-one basis and can aggregate up to any number of submarines on both friendly and enemy sides. Simulated time is treated on a time step basis. Probability theory and a decision logic table are the primary solution techniques used.

INPUT:

- o Tactical scenario
- o Detailed data on weapons, sensors and equipments

OUTPUT:

- o Computer printout from which analysis can be done
- o Data reduction for each replication
- o Across replications and computer pilots
- o 5 options ranging from summary data to detailed battle history

MODEL LIMITATIONS: Oriented toward one-to-one encounters

HARDWARE:

- o Computer: CDC 6700, UNIVAC 1108, IBM 360
- o Minimum Storage Required: 35K
- o Peripheral Equipment: Printers
  Plotting options exist that would require a plotter
  4 Tape Drives

SOFTWARE:

- o Programming Languages: FORTRAN IV
- o Both user's documentation and technical documentation:
  Abstract (AD 909 474L) 50
  Technical Description (AD 525 118L)
  Programmer's Manual (AD 9092546)
- o An updating set of documentation will be published in 1977.

TIME REQUIREMENTS:

- o An extensive data base is available at the developing site for most applications
- o 30 seconds CPU time per model cycle
- o 2-3 days learning time for users
- o 20 days to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 25 times per year

USERS:

- o Principal: MASWSP
- o Other: Naval Laboratories

POINT OF CONTACT: Manager, ASW Systems Project
Navy Department
Washington, D. C. 20360
Telephone: 202/692-9141

MISCELLANEOUS:

- o APSUB MOD 2 supersedes the NWL Submarine Encounter Simulation Model.
- o Continual updating is planned in the areas of sonar, fire control and weapons.
- o A computer-assisted version of APSUB MOD 2 is currently being prepared. Extensive documentation for this version is being developed and will be available shortly.

KEYWORD LISTING: Analytical Model; Limited War; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step; Anti-Submarine Warfare

TITLE: APSURF Mod I, ASW Programs Surface Ship Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: J. D. Kettelle Corporation

PURPOSE: APSURF is a computerized, analytical model for the simulation of an ASW engagement between an enemy submarine and a Task Force or convoy of surface ships, including helicopters and LAMPS. Covers complete engagement from search to attack, reattack and kill.

GENERAL DESCRIPTION: The model is a two-sided, stochastic, Monte Carlo simulation, considering 25 surface ships, 25 helicopters/LAMPS, and 1 submarine. Time is covered in a time step mode. Weapons, fire control, sensors, platform noise and kinematics, environment and tactics are considered.

INPUT:

- o Sensor characteristics
- o Weapon characteristics
- o Platform characteristics
- o Fire control characteristics
- o Tactics
- o Scenario

OUTPUT: Printout and plots of all statistically derived quantities

MODEL LIMITATIONS:

- o One enemy submarine
- o No countermeasures

HARDWARE:

- o Computer: CDC 6400, 6600, 6700, IBM 360
- o Minimum Storage Required: 250K plus 4 tape drives

SOFTWARE:

- o FORTRAN IV
- o Documentation: Abstract AD881384L; User's Manual AD881385L, AD881386L; Programmers manual AD881387L, AD881388L

TIME REQUIREMENTS:

- o Prepare data: 1 man-month
- o CPU time: 30 seconds
- o Analyze results: 3 weeks

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 30 times per year

USERS: MAWSP, CRUDESDEVGRU

POINT OF CONTACT: Manager, ASW Systems Project Office
Navy Department
Washington, D. C. 20360
Telephone: 202/692-9141

KEYWORD LISTING: Analytical; ASW; Air and Sea; Computer Model; Two-Sided; Stochastic; Time Step; Submarine

NOTE: There is now an APSURF Mod 2. The documentation for this model will be published in 1977. The major added differences are:

(a) Improved Helo (SH-3 type)
(b) LAMPS, MK III with appropriate navigation, weapons, sensors, etc.
(c) Good treatment of towed arrays, including beamforming, noise, etc.
(d) Added key words for more comprehensive tactics

TITLE: APSURV - ASW Program Surveillance Model

PROPONENT: Chief of Naval Operations (OP-95)

DEVELOPER: Tetra-Tech, Inc.

PURPOSE: APSURV is a computerized, analytical model which simulates ASW interaction between an enemy submarine and a surveillance system which detects the submarine, thereby permitting study of the search, detect, and localization process for the sensors.

GENERAL DESCRIPTION: APSURV is a two-sided, stochastic model for ASW operations involving one submarine against one sensor at a time for up to 20 sensors. Time is treated in a time-step mode.

INPUT:

- o Submarine track
- o Propagation loss
- o Ambient noise
- o Sensor characteristics
- o Submarine tactics

OUTPUT:

- o Computer printout and plots of statistics and derived quantities

MODEL LIMITATIONS: No false targets are simulated.

HARDWARE:

- o Computer: CDC 6000, UNIVAC 1108, IBM 360
- o Minimum Storage Required: 100K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Mod - Defense Documentation Center Numbers
  - 0 - AD511 611L, AD511610L
  - 1 - AD 513 177L

TIME REQUIREMENTS:

- o Structure data base: 1 month
- o CPU time: 20 seconds

SECURITY CLASSIFICATION:

- o Mod 0: SECRET
- o Mod 1: CONFIDENTIAL

FREQUENCY OF USE: 25 times/year

USERS: OP-95
OP-96
PME-124

POINT OF CONTACT: Manager, ASW Systems Project
Navy Department
Washington, D. C. 20360
Telephone: 202/692-9141

KEYWORD LISTING: Analytical; ASW; Submarine; Computerized; Two-Sided; Time Step

NOTE: There is an APSURV Mod 1.4 nearly documented and a Mod 2.0 under construction. Information is available on these models, but not complete documentation.

TITLE: ASGRAM - Anti-Submarine Graphical Resource Allocation Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Johns Hopkins Applied Physics Laboratory and Strategic Analysis Support Group, OP-96

PURPOSE: ASGRAM is an interactive, computer-assisted graphics model used for both analysis and training. It is designed to simulate the allocation of anti-submarine forces to a submarine threat. It has been used to study the capability of existing naval force levels in the detection and tracking of hostile submarine surge deployments. It has not been used for other studies. It may be used to study support and force allocation doctrines or to study the distribution of forces and resources among existing air-bases.

GENERAL DESCRIPTION: ASGRAM is an interactive, time-step Monte-Carlo simulation possessing both deterministic and stochastic elements. Air and sea forces are involved. The model considers surface ships, submarines, and aircraft on an individual basis with a maximum of 99 friendly ships (destroyers or submarines), 190 VP aircraft, and 50 hostile submarines. This represents the ASW threat and defensive forces for one ocean. Simulated time is treated on a time step basis. The ratio of game time to real time is 1:60, when the maximum number of units is used. The primary solution technique is kinematic with probabilistic assessment of interactions between Red and Blue forces.

INPUT:

- Course tracks for hostile submarines
- Probability of detection of SOSUS against hostile units along their input tracks
- Various probabilistic assessment factors

OUTPUT:

- Battle history, sorted as desired
- Contact summary

MODEL LIMITATIONS:

- 100 friendly ships (destroyers or submarines)
- 200 VP aircraft
- 50 hostile submarines
- Because the model is interactive, the time to complete a single replication will depend directly on the number of units and the game's scenario.

HARDWARE:

- Computer: IBM 360/91
- Operating System: Time Sharing Option
- Storage Required: 400K
- Peripheral Equipment: IBM 3270 CRT display, TEKTRONIX 4015 Graphics display terminal, hard copy device

SOFTWARE:

- o Programming Language: P L/1
- o Documentation: "Anti-Submarine Graphical Resource Allocation Model (ASGRAM), Version II," APL/JHU/PAG No. 58-74, CNO/OP-96-CM-3360, December 1974

TIME REQUIREMENTS:

- o 1/2 man-month to prepare input
- o 10 hours per 30 game days playing time (see model limitations)
- o Approximately 30 seconds CPU time per model cycle
- o 3 hours training time for players
- o 1 week to analyze and evaluate results (dependent upon number of units and scenario)

SECURITY CLASSIFICATION: SECRET

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

FREQUENCY OF USE: Used extensively for three major studies

PRINCIPAL USER: Strategic Analysis Support Group (SASG), OP-96

MISCELLANEOUS:

- o ASGRAM takes input from the APSURV model in the form of detection probabilities generated by APSURV for the SOSUS system.

KEYWORD LISTING: Analytical; Training; General War; Limited War; Air Forces; Sea Forces; Computer-Assisted; Two-Sided; Mixed Stochastic/Deterministic; Time Step; Graphics; Resource Allocation

TITLE: ASWAS - ASW Air Systems Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: ASWAS is a computerized, analytical model designed to simulate search, localization, tracking, attack and reattack by a single aircraft against a single submarine. The primary focus of concern is ASW missions such as SOSUS, flaming datum, barrier, and screening. In addition, it addresses the problem of developing optimum localization tactics for aircraft.

GENERAL DESCRIPTION: ASWAS is a two-sided, stochastic model involving air and sea forces. It considers an individual aircraft versus a single submarine. Sonobuoys are considered units, and the model can handle up to 31 of these. Simulated time is treated on an event store basis. Approximately three hours of battle are simulated in one second. The primary solution technique is kinematic, with probabilistic event assessment.

INPUT: ASW scenario

OUTPUT:

- o Event-by-Event history
- o Statistical analysis

MODEL LIMITATIONS:

- o No convergence zone capabilities
- o One aircraft and one submarine per replication
- o Maximum of 31 sonobuoys

HARDWARE:

- o Computer: IBM 7090/7094
- o Operating System: FORTRAN Monitor System
- o Minimum Storage Required: 70K octal

SOFTWARE:

- o Programming Language: FAP (FORTRAN Assembly Program)
- o Documentation: "ASW Air Systems Model (ASWAS)," PAG No. 19-68, OM 3360
- o The above represents complete user's and technical documentation

TIME REQUIREMENTS:

- o 1 week to prepare input (1 man-week)
- o Approximately .03 seconds CPU time per model cycle (approximately 3 minutes run time per 100 replications)
- o 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Annually

USERS: Strategic Analysis Support Group, OP-96

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

MISCELLANEOUS: ASWAS supplied inputs to ASGRAM in the form of tactical effectiveness of various units; probabilities of detection and probabilities of kill. ASWAS was also used in studying helo detection capabilities within towed array uncertainty areas.

KEYWORD LISTING: Analytical Model; Limited War; Damage Assessment/Weapons Effectiveness; Air Forces; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: ATLAS - A Tactical, Logistical and Air Simulation

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation

PURPOSE: ATLAS is a computerized, analytical model designed to assist the planner/analyst by simulating conventional theater level combat operations over an extended period, and to examine the overall trends, effects, and interactions of ground, air and logistic forces in conventional theater level warfare. It is basically a planner's war game, providing the tool for examining theater level force interactions so that the planner/analyst may examine and evaluate theater level contingency planning, force effectiveness and force requirements. The daily movement of a FEBA is analyzed as a function of firepower, terrain, posture, residual personnel strengths, and logistic support. The model is also concerned with the scheduling of reinforcements and logistic capability of lines of communication.

GENERAL DESCRIPTION: ATLAS is a two-sided, deterministic model involving land and air forces. It was primarily designed to consider division level ground forces and aircraft by mission. The model may be manipulated, however, to consider units down to brigade or battalion level, if the gamer can accept division casualty and movement "rates." The model was designed to consider combat operations by "sector." Each "sector" was designed to represent a corps level force. Up to ten sectors (corps) can be simulated in a representation of theater level combat. Time is treated on a time step basis (24-hour increments). The primary solution technique is average expected value results evaluated deterministically.

INPUT:

- o In general, inputs fall into four major categories:
  - (1) Environmental inputs which structure the theater;
  - (2) Ground force inputs of committed and scheduled forces and their associated characteristics;
  - (3) Logistic inputs which establish supply requirements and constraints;
  - (4) Air inputs which provide performance, vulnerability, and other characteristic data on aircraft, airbases, and SAM sites.

OUTPUT: Model output is in computer printout form somewhat similar to the input data format. Output is tabulated on a daily basis and reflects the current status of forces at a given time. The planner/analyst must incorporate model results into his analysis of the theater scenario. Selective detailed and summary output is available. Output may be requested for specific days and for specific submodels (ground, air or logistics) or for a comprehensive theater summary. Retrievals of selected data items are also available using the ATLAS data conversion and retrieval programs.

MODEL LIMITATIONS: In ATLAS, the battle assessments are primarily dependent on the ratios of the opposing forces computed from firepower scores (FPS). The Index of Combat Effectiveness (ICE) values are modified by casualties or lack of supplies to form a net ICE. At the present state of gaming, weapon firepower effects are assumed to be linearly additive with no enhancement (or degradation)

for training, morale, combined arms, and command and control. These factors are usually unknown at the lead time at which the force planner works. Therefore, the planner must emphasize in his analysis those combat factors that he can control or that are calculable. The expression of average expected results, based solely on comparative modified firepower scores, can be misleading or even wrong unless all the ingredients of battlefield success are considered and found to be essentially in balance.

HARDWARE:

- o Computer: IBM 360/50 or 360/65; CDC 3600 or 6000; UNIVAC 1108
- o Operating System: IBM S/360: MFT/MVT and HASP with O.S. Release 19.6; CDC 6000 Series: SCOPE 3+; UNIVAC 1108; EXEC VIII
- o Minimum Storage Required: 186K bytes of core for IBM machines; 120K for CDC, 43K words for UNIVAC 1108
- o Peripheral Equipment: Up to two 9-track tape drives and/or a 2316 disk pack for IBM machines; up to two drives for CDC 6000 series

SOFTWARE:

- o Programming Language(s): FORTRAN V (UNICAC 1108)
  FORTRAN IV and ALC (IBM 360 Series)
  FORTRAN IV (CDC 6000 Series)
- o Documentation: "Computerized Quickgame" RAC-TP-266 (AD 387 510)
  "ATLAS: A Tactical, Logistical and Air Simulation: RAC-TP 338 (AD 850 355)
  SHAPE TM 242
  NMCC CSM UM 91-69
- o User's documentation is complete. Technical documentation is not complete, although considerable technical documentation exists in draft form.

TIME REQUIREMENTS:

- o 2-4 months to acquire base data, depending on Service responses
- o 1 man-month to structure data in model input format
- o CPU time per model cycle: CDC 6000 Series: .2 minute
  IBM 360 Series: .6 minute
  UNIVAC 1108: 24 minutes for 180 day game

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 600 times per year

USERS:

- o Principal: Special Studies Div, Studies, Analysis, and Gaming Agency, OJCS
  DA ACSFOR
  DCSOPS
- o Other: US Army Concepts Analysis Agency, SHAPE Headquarters, CINCPAC and COMUSKOREA

POINT OF CONTACT: UNIVAC version - MS. P. M. Fleming
United States Army Concepts Analysis Agency (MRM)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1645

CDC version - Gaming and Simulations Department
General Research Corporation
McLean, Virginia 22101
Telephone: 703/893-5900

IBM version - Special Studies Division (SSD)
Studies, Analysis, and Gaming Agency (SAG)
Organization of the Joint Chiefs of Staff (OJCS)
The Pentagon, Washington, DC 20301
Telephone: 202/695-9003

MISCELLANEOUS:

- ATLAS has computerized interfaces with the ATLAS Data Conversion and Retrieval Programs and with the Simulation for the Assessment of Tactical Nuclear Weapons (SATAN II) Programs. The manual gamer interfaces with the SAGA TANGO family of models. The user also has the option of linking up to the FASTALS model in the FOREWON planning system.
- ATLAS is an improved version of the original Research Analysis Corporation (RAC) Computerized Quickgame.

KEYWORD LISTING: Analytical Model; Limited War; Logistics; Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time-Step

TITLE: ATR - Air Transport of Radiation

PROPONENT: Defense Nuclear Agency (RATN)

DEVELOPER: Science Applications, Inc.

PURPOSE: The ATR code provides detailed descriptions of the free-field nuclear environments for all burst-target configurations in the atmosphere. The code utilizes field free input commands and performs a typical calculation in less than a computational second.

GENERAL DESCRIPTION: The ATR code contains parametric models of a comprehensive data base of air transport claculations performed by discrete ordinates techniques. The data base was generated for neutrons, secondary gamma rays, prompt gamma rays, and x-rays as a function of source energy, range, detector energy, and angle to a distance of 550 gm/cm^2 of infinite homogeneous air. Results at all configurations of distance and density are obtained by integral mass scaling upon these infinite, homogeneous air results. Effects of the interface between air and ground and of non-uniform air density at high altitudes are treated as perturbation corrections.

INPUT: All input utilizes a field free nmemonic command structure.

- o Burst-target configuration
- o Source spectra and weapon yield (internal sources are available if desired)
- o Output specifications

OUTPUT: All at user option with a full complement of units (km, kft, miles, gms/cm^2, cal/cm^2, etc.).

- o Full energy angular dependent

  fluence — energy fluence
  current — energy current
  dose (several internal dose responses plus user specified)

- o Several convenient summary printout options
- o Constraint calculation (finds the range for a given dose)

HARDWARE:

- o Operational on Univac 1108, CDC 7600/6600, IBM 360/91, GE 635, Dec 10
- o Uses no external storage devises
- o Requires approximately 60K

SOFTWARE:

- o Fortran IV
- o "Users Guide to Version 2 of ATR (Air Transport of Radiation)," L. Huszar, L. Nesseler, W. Woolson, DNA 3144Z (SAI-73-534-LJ), April 1973.

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TIME REQUIREMENTS:

- Less than 1 man-hour to define problem in ATR command structure
- Less than 1 second computational time on Univac 1108 for typical problems
- Data formatted for easy interpretation

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used at several installations on a day-to-day basis.

USERS: (Representative list)

Ballistics Research Lab (BRL)	Army Nuclear Agency (ANA)
Defense Nuclear Agency (DNA)	Air Force Weapons Lab (AFWL)
	Science Applications, Inc. (SAI)

POINT OF CONTACT: Dr. William A. Woolson
Science Applications, Inc.
1200 Prospect Street, P. O. Box 2351
La Jolla, California 92037
Telephone: 714/459-0211

KEYWORD LISTING: Radiation transport; secondary gamma-ray; x-ray; atmosphere; computerized; neutron; prompt gamma-ray; dose; fluence.

TITLE: BAM - Blue Artillery Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The Blue artillery model is used for analysis.

GENERAL DESCRIPTION: The Blue artillery model is a computerized, deterministic model. It accepts the acquired target list from the Target Acquisition Model and assigns the deployed artillery batteries to fire missions based upon the target list. The assignment of batteries is guided by a set of rules programmed into the model. Simulated time is treated on an event store basis. The solution technique used is that of a computer simulation algorithm.

INPUT:

- Acquired target list which includes target location, type, size, and environment
- Location of all Blue artillery batteries

OUTPUT:

- Computer printout of a list of time sequenced fire missions
- A summary of rounds fired by round type, casualties achieved, and armor losses to artillery fire

MODEL LIMITATIONS: Limited to ten types of artillery, two environment, and 16 types of targets.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 32K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Blue Artillery Model, December 1974, USACAA. Available in the Defense Documentation Center.
- The above publication is a complete user's and technical documentation.

TIME REQUIREMENTS:

- Approximately 1 man-month to acquire basic data
- 0.25 man-months to structure data in model input format
- 2 minutes CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 times per year

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: The Blue Artillery Model provides input data to the Theater Rates Model.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Artillery; Deterministic

TITLE: Battalion Level Differential Model

PROPONENT: US Army Combined Arms Combat Developments Activity

DEVELOPER: Vector Research, Inc.

PURPOSE: The Battalion Level Differential Model is a computerized, analytical, limited war model which involves combined arms engagement of approximately battalion versus regimental force or lower. The model is concerned with the combat effectiveness of various mixes of weapons systems. It is also concerned with investigations of weapon parameters and levels of training.

GENERAL DESCRIPTION: This model is two-sided and deterministic, involving land and air forces. It is capable of aggregating 1-3 weapons systems of the same type. The level of exercise for which the model was primarily designed considers battalion versus regiment, with a range of possible manipulation to include regiment versus regiment. Simulated time is treated on a time-step basis. The primary solution techniques used are Lanchester differential equations (Bonder methodology).

INPUT:

- o Mobility file giving location at attackers for each time step
- o Weapon performance data
- o Target priority data
- o Force strengths

OUTPUT:

- o Computer printout: all firings, and at each time step, the number of survivors and total ammunition expended by weapon type.

MODEL LIMITATIONS:

- o Not self-contained - must use preprocessed mobility data
- o Currently has inactive defense (no defender movement)

HARDWARE:

- o Computer: CDC 6400/6500
- o Operating System: SCOPE 3.4
- o Minimum Storage Required: 8K
- o Peripheral Equipment: Card reader, printer, permanent file set

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Analysis methodology in support of CLGP COEA
- o Both user's documentation and technical documentation are complete

TIME REQUIREMENTS:

- o 4 months required to acquire base data
- o 2 man-months to structure data in model input format
- o 12 minutes CPU time per model cycle
- o 2 months to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 4-5 times per year

USERS:

- o Principal: Combat Operations Analysis Directorate
  Ft. Leavenworth, Kansas
- o Other: Field Artillery School, Ft. Sill, Oklahoma

POINT OF CONTACT: Dr. Robert Schwabauer
Combat Operations Analysis Directorate
ATTN: ATCA-CAT
USA Combined Arms Combat Developments Activity
Ft. Leavenworth, Kansas 66027
Telephone: Autovon 552-3193

MISCELLANEOUS: The Battalion Level Differential Model is linked to DUNTACS. DYNTACS makes mobility file which BLDM uses. BLDM supersedes BONDER IUA/ AIRCAV 5. It is planned to add to this model the following capabilities: Mobility kills, unaggregated LOS, active defense, improved detection.

KEYWORD LISTING: Computerized; Analytical; Limited War; Two-Sided; Deterministic; Time-Step; Land Forces; Air Forces

TITLE: BUILDUP

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: The BUILDUP model determines the buildup of commodities at their destinations after they have traveled through multimodel transportation networks. It provides the analyst with a tool to determine the sensitivity of the buildup rate to changes in many parameters of the transportation system.

GENERAL DESCRIPTION: BUILDUP is a multi-sided, deterministic model involving land, sea, or air vehicles. The heart of the program is an algorithm for minimizing the time to move "packages" through multimodel transportation networks without losing the identity of the package. This algorithm selects from all feasible routes from the origin to destination that route which permits the package to arrive at its destination on the earliest day.

INPUT: Card images from detailed files generated by the Movement Requirements for Studies and Analysis (MORSA) file and updated from RAPIDSIM simulations via processing programs.

- Number of periods being simulated
- Number of vehicle classes
- Onload time
- Offload time
- Speed, in kilometers per day, for each vehicle class

OUTPUT:

- Output is in the form of computer listings reflecting:
  (1) The link origin
  (2) The link terminal
  (3) The mode of the link
  (4) The length of the link
  (5) The capacity of the link
  (6) The time to traverse the link in days
  (7) Vehicle limit by class
  (8) Speed in km/day for each vehicle class

MODEL LIMITATIONS:

- Maximum number of links - 1600
- Maximum number of nodes - 450
- Maximum number of modes - 20
- Maximum number of vehicles - 20
- Maximum number of days - 40
- Maximum number of packages - 900

HARDWARE:

- Computers: CDC 6400; HIS 6080; IBM 360
- Operating System: SCOPE (CDC); GCOS (HIS); OS (IBM)
- Minimum Storage Required: 35K words (CDC); 55K words (HIS); 250K bytes (IBM)
- Peripheral Equipment: Tape and disk drive

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Users Manual, General Research Corporation, March 1974
- o Technical documentation is not available.

TIME REQUIREMENTS:

- o 10 man-hours to structure input
- o 30 minutes CPU time per model cycle
- o 1-10 man-days to analyze results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS:

- o Principal: Organization of the Joint Chiefs of Staff (J-4)
- o Other: Director, Planning and Evaluation
  Studies, Analysis, and Gaming Agency

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon
Washington, D. C. 20301
Telephone: OX7-5464

MISCELLANEOUS: The BUILDUP model can be processed via MULTICS.

KEYWORD LISTING: Analytical Model; Computerized; Transportation; Deterministic

TITLE: CADENS IV - CONUS Air Defense Engagement Simulator

PROPONENT: US Army Air Defense School, Directorate of Combat Developments

DEVELOPER: US Army Air Defense School, Directorate of Combat Developments

PURPOSE: The CONUS Air Defense Engagement Simulator (CADENS-IV) represents interactions which occur between varying deployments of air and ballistic missile defensive systems and attacks by integrated strategic forces. The CADENS model is designed to simulate either a one-sided or two-sided war-game up to a size global in nature. The CADENS model provides a flexible tool for evaluation of continental air defense effectiveness, and global games anticipated in Red Integrated Strategic Operations Plans (RISOP).

GENERAL DESCRIPTION: The CADENS model is a rigid two-sided event stepped (with the exception of the dynamic AWACS search), Monte Carlo, multi-replication simulator. Both nuclear and non-nuclear effects are played. The offensive systems exercised are: (1) ICBMs with MRV, MARV, and MIRV; (2) SLBMs; (3) SLCMs; (4) bombers with ASMs or gravity bombs; (5) ASM; (6) FOBs; (7) AWACS-Killers with on-board radars. The defensive systems exercised are: (1) fighter-interceptor with onboard ground control a/o airborne control; (2) SAM defenses with AADCPs; (3) AWACS; (4) C^3; (5) tankers; (6) ABM defenses; (7) OTH-B. The CADENS-IV model consists of 5 interrelated, stand alone, but sequentially linked programs: (1) Input Editor; (2) Preliminary Event Generator; (3) Engagement Simulator Start; (4) Main Game; and (5) Output Editor. Damage is determined to be light, moderate, or heavy with accompanied time penalties. Radar blackout is exercised as to its effect on radar performance and missile flyout. End game damage assessment is provided by requesting burst punched card output. The analyst may select to exercise only a ballistic missile exchange, a single SAM defense (or battery), a large scale air-to-air battle, or any combination over any size geographical area. The sizing of the CADENS-IV model is as follows:

o Area of Play	Up to Global
o # Defenses	63
o Defense Entities:	444
Per Defense:	127 C^2 Sites, 127 Sensor Sites
By Type:	127 FUs or Airbases
	63 AWACS Complexes
o Offensive Cells/Objectives	4095/28665
o SAM System Types	63
o Fighter Interceptor Types	7 at 63 F.I. Base Types
o Sensor Types	63
o ABM System Types	63
o Threat Types	31

INPUT: Except for a few control cards used for the 5 programs, all data requirements are handled by the Input Editor Program. A complete global game exercising the complete strategic spectrum would require the following inputs in the order listed:

- o Control Cards
- o Threat Characteristics
- o C^2 Characteristics
- o Sensor Characteristics
- o F.I. Base Characteristics
- o Aircraft Characteristics
- o Aircraft Weapon Characteristics
- o SAM Missile Characteristics
- o ABM Missile Characteristics
- o SAM Defenses
- o FI Defenses
- o ABM Defenses
- o Communications
- o ICBM/SLBM Attack Plan
- o AST Attack Plan

OUTPUT: The output Editor Program is structured to allow for selectivity of desired output. The analyst may request all replications history of game play, in a time ordered, chronological sequence, or sorted according to the numbered defense, or all three sorts for all replications. By placing a few control cards, you can extract only the data desired, at the level of granularity and for any desired data for all replications. In addition, the chronological order by replication of all bursts can be punched in a readable format to determine level and time of damage occurring to targets that do not participate in the game play.

MODEL LIMITATIONS:

- No interface between SAM and AWACS
- The AAA gun is not modeled
- Terrain is assumed smooth earth
- ECM is programmer controlled through input

HARDWARE:

- Computer CDC 6000 series
- SCOPE, 3.3
- Two magnetic tape drives
- Core 14,700 Octal

SOFTWARE:

- Programming Language: FORTRAN IV
- Compass
- Documentation available from USAACS, Ft. Bliss, Texas

TIME REQUIREMENTS: A small air battle of 10-20 hostile tracks penetrating a single defensive region exercised over ten replications requires approximately 30 minutes of CPU time. A large to moderate size game exercising 1000 missile tracks or more requires approximately 3 hours of CPU time. A maximum game of 1700 missile tracks and 650 bomber tracks across a total continental defense posture requires approximately 4 hours CPU time.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly

USERS: NORAD-J5, USAADS

POINT OF CONTACT: US Army Air Defense School (ATSA-CD-SS)
Fort Bliss, Texas 79916
Telephone: 915/568-7500
Autovon 978-7500/6238

KEYWORD LISTING: Analytical Model; Strategic Forces; ICBM/SLBM; ABM; SAM OTH-B AWACS; F.I.; A.F.I.; AWACS Killers; Blackout; Blast; Nuclear Effects; Fratricide; SLCM; FOBs; Radar; Monte Carlo; Stochastic; Event Step

TITLE: CAM - Artillery Casualty Assessment Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest development has been done in-house.

PURPOSE: The Artillery Casualty Assessment Model is a computerized model used for analysis. It assesses casualties and armor losses achieved by indirect fire weapon systems.

GENERAL DESCRIPTION: The Artillery Casualty Assessment Model is a one-sided, stochastic model involving land forces only. It is capable of considering anywhere from one battery volley to thirty battalion volleys. Simulated time is treated on an event store basis. Monte Carlo is the primary solution technique used.

INPUT:

- o Target size, environment , and posture sequence
- o Weapon firing errors and lethal areas for munitions

OUTPUT: Printout of casualties for each volley fired at target

MODEL LIMITATIONS:

- o Circular targets only
- o Lethal areas only

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Artillery Casualty Assessment Model, December 1974, USACAA. Available in the Defense Documentation Center.
- o The above represents complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 man-weeks to structure data in model input format
- o 2 minutes CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3,000 time per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: The Artillery Casualty Assessment Model provides input to the Blue and Red artillery models.

KEYWORD LISTING: Analytical Model; General (Nonnuclear); Land Forces; Computerized; One-Sided; Stochastic; Event Store

TITLE: CAM-SAAB - Countering Anti-Ship Missiles - Simulated Air-to-Air Battle

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Center for Naval Analyses

PURPOSE: CAM-SAAB is a computerized fleet air defense model designed to ascertain the level of attrition that defensive interceptor aircraft can inflict upon the missile-carrying aircraft of attack formations. The model determines the effect of using various fleet interceptors such as F4s or F14s, with various weapon loads and with varying radar configurations.

GENERAL DESCRIPTION: CAM-SAAB is a two-sided model having both deterministic and stochastic elements. Only air forces are involved. The model is designed to consider from one to one hundred individual defensive aircraft versus from one to fifty offensive groups. Offensive groups may consist of any member of aircraft from one to some practical limit of about thirty. The model can aggregate up to fifty such raid groups versus one to four aircraft carrier fleets. (Aircraft are either in the game or not. Unlike many such games, no fractional aircraft fly.) Simulated time is treated on an event-store basis. The primary solution technique used is probability. Individual aircraft maneuver and engage in three-dimensional space.

INPUT:

- Fleet and raid makeup and position
- Weapon characteristics
- Radar characterisitcs
- Weather conditions
- Interceptor launch strategy
- Interceptor/raid escort tactics

OUTPUT:

- Summary data of raid/defensive aircraft destroyed, number of ASMs launched, etc.
- Detailed results of individual interceptions.
- Detail and summary outputs are available for each iteration.
- Detailed step-by-step printouts are also available for each event within a selected iteration. Tape outputs are also available of the step-by-step printouts, and of the detail and summary outputs for analysis programs. Subsequent programs summarize across iterations.

MODEL LIMITATIONS:

- The only interceptors provided for are F4s and F14s.
- The only missiles provided for are the Phoenix, Sparrow (E,F), and Sidewinder.
- Maximum of 6 AEW, 12 CAP, 100 DLI, and 50 raid groups.
- Maximum of 1 task group center.

HARDWARE:

- o Computer: CDC 3600, CDC 3800, CDC 3400
- o Operating System: SCOPE
- o Minimum Storage Required: 32K, but 65K is preferred.
- o Peripheral Equipment: 2 scratch units (disk or drum files, or scratch tapes).

SOFTWARE:

- o Programming Language: FORTRAN, COMPASS (ASSEMBLY)
- o Documentation consists of a Model Description, Input Specifications, General Flow Description, Narrative Description of Major Routines, Radar and Geometrical Equations Used, Vectoring and Engagement Relationships. Both user's documentation and technical documentation are complete. Certain technical documents are classified confidential.

TIME REQUIREMENTS:

- o 6 months to acquire base data
- o 2 man-weeks to structure data in model input format
- o 30 seconds CPU time per model cycle

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 100 per year

USERS: Center for Naval Analyses

POINT OF CONTACT: Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia 22209
Telephone: 703/524-9400

MISCELLANEOUS:

- o CAM-SAAB is linked to CAM/SAM (Countering Anti-Ship Missiles - Surface to Air Missile Submodel) which deals with ASMs after launching. CAM-SAAB indicates the numbers and sources of these missiles after the air-to-air battle.
- o CAM-SAAB supersedes FAA and SAAB.

KEYWORD LISTING: General War (Non-Nuclear); Air Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Event Store

TITLE: CAM/SAM - Countering Anti-Ship Missiles - Surface-to-Air Missile Submodel

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Center for Naval Analyses

PURPOSE: CAM/SAM is a computerized model that addresses the problem of ship-based surface-to-air missiles (SAM) defense against attacking air-to-surface missiles (ASM) and surface-to-surface missiles (SSM). Assumptions in the model limit battle time to less than one hour (the model is primarily designed for a 20-30 minute engagement), but the model is designed for consecutive runs (provided that input data is updated) using the end of the previous engagement as the start time for the second engagement. In addition, the model addresses the following problems: (1) SAM anti-ship missile interactions; (2) interceptor engagements; (3) electronic countermeasures; (4) guns (platforms and/or missiles); (5) sensitivity studies on the vulnerability of shipboard systems simulated, including task configuration.

GENERAL DESCRIPTION: CAM/SAM is a two-sided, stochastic model designed to consider a task force (whose ships are ranked by four levels of priority) against any number of attacking ASMs or up to 60 ships (of 15 classes) with 10 radar classes, 5 jamming locations, 2 jamming power levels, 50 SAM batteries (of 10 classes) and up to 4 batteries per ship (including BPD), with 6 fire control channels and 4 launcher rails per battery. It can also consider anywhere from one attacking enemy missile to 99 ASMs launched, or up to 50 ASM launch sources, with any number of missiles being launched from any source. SAM and ASM may be nuclear, conventional or mixed. Attacking missiles are limited to 5 weapons classes. Simulation of a minute of combat requires a minute of computer time. The primary solution techniques used are Monte Carlo, mechanized bookkeeping, and probability-random numbers to test survivability.

INPUT:

- Detectability ranges for each radar class
- Description of radar classes
- Description of jamming sources
- Description of enemy weapon classes
- Description of SAM classes (Talos, Tarrier, etc.)
- Detection and lock-on delay distributions for each radar class
- Description of ship classes
- Ship positions
- ASM descriptions or ASM launch source descriptions
- ECM interference levels
- Miscellaneous game inputs and print options

OUTPUT: Output runs the spectrum from stop action reports on all systems and missiles to summaries of any number of iterations, including mean and standard deviations. Plots and histograms are also available. Some options are:

- Data array sequentially printed
- List of events stored and retrieved
- Ship, SAM and ASM status arrays at end of game
- Intercept time and coordinates
- Priority assessment event printout
- Jamming strobe arrays
- Reaction decision event printout

- o Lock-on/decision-to-fire event printout
- o SAM launch event
- o Intercept event
- o ASM impact event
- o Kill assessment event
- o ASM launch/detection event printout
- o Random targeting information
- o Partial input arrays
- o Targeting list
- o Intercept diagram of SAM trajectories
- o Event sequence printout for each SAM battery

MODEL LIMITATIONS:

- o See General Description (above) for maxima of ships, radars, batteries, missiles, etc.
- o Maximum duration of 99.99 minutes

HARDWARE:

- o Computer: CDC 3800
- o Operating System: SCOPE
- o Minimum Storage Required: 26.5K
- o Peripheral Equipment: Plotter (optional), load and go tape or card reader

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a set of appendices to NAVWAG Study No. 62, "Countering Anti-Ship Missile Study," CONFIDENTIAL. Appendix I of Volume 6 illustrates the computer model and describes inputs.
- o User's documentation is complete through September 1971. Technical documentation is complete through December 1970. Beyond the Appendix I mentioned above, there is no complete user guide or programmer manual.

TIME REQUIREMENTS:

- o About 2 months to acquire base data
- o Up to 1 man-month to structure data in model input format
- o Approximately 1 minute CPU time for an average iteration, although this varies with the size of the game
- o Maximum of 1 month learning time for users
- o Up to 6 months to analyze and evaluate results

SECURITY CLASSIFICATION: The model is CONFIDENTIAL. Input is SECRET.

FREQUENCY OF USE: Twice annually.

USERS:

- o Principal: Center for Naval Analyses
- o Other: Carderoc, Applied Physics Laboratory, Pentagon

POINT OF CONTACT: Center for Naval Analyses
1400 Wilson Boulevard
Arlington, Virginia 22209
Telephone: 703/524-9400

MISCELLANEOUS:

- CAM/SAAB provides input to the CAM/SAM in the form of the numbers and sources of ASMs after air-to-air battle.
- CAM/SAM supersedes the FAAW-III Model.
- It is currently planned to add a more realistic nuclear game to the model, including psi effects, etc.

KEYWORD LISTING: Limited War; Air Forces; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: CAMP - Computer Assisted Match Program

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: CAMP is used as a tool in force structuring and analysis and in strategic mobility analysis. CAMP interfaces DA force planning files (Force Accounting System), CAA's Force Analysis Simulation of Theater Administration and Logistic Support (FASTALS) theater roundout model, and various logistical data files to produce force movement requirements for input to various strategic mobility models.

GENERAL DESCRIPTION: CAMP consists of two major functions: Force Match Algorithm (FMA) and Movement Requirements Generator(MRG). FMA compares an actual or planning force with time phased type unit requirements for a specific situation and scenario. Required units are selected and assigned a destination theater and required delivery data (RDD). Notional units are created to make up shortfalls on the force. MRG develops detailed movement requirements (origin, destination, travel mode, availability date, RDD and movement characteristics) for all deploying units, determines non-unit movement requirements (materiel resupply, personnel replacements and fillers) to support the deployed forces. Unit and non-unit movement requirements are developed in the format required for input to various strategic mobility models used at CAA and at Joint Chiefs of Staff (JCS) level. CAMP has been interfaced with the Unit Data System (UDS) to provide a generalized report generator capability.

INPUT:

- o Type unit requirements such as those provided by the FASTALS model
- o Force Accounting System (FAS) force file
- o TUCHA (Type Unit Characteristics) file
- o Geographic Location Codes
- o POMCUS and Preposition War Reserve Data
- o Resupply, Consumption and Casualty Rates
- o Other service movement requirements

OUTPUT:

- o Force Accounting System file overlaid with match results
- o Army movement requirements in mobility Requirement for Staff Analysis (MORSA) format
- o Multi-service movement requirements in Strategic Mobility Simulation Model (SMOBSMOD) or Transportation Model (TRANSMO) format

MODEL LIMITATIONS:

- o Many input files are not produced at CAA. Quality control of these files is sometimes difficult

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 60K words
- o Peripheral Equipment: Mass storage devices and tape drives

SOFTWARE:

- o Programming Language: FORTRAN and COBOL
- o Documentation: CAA-D-76-5, Computer Assisted Match Program (CAMP), August 1976
- o Program size: 57K maximum; 35K average

TIME REQUIREMENTS:

- o 2 weeks to acquire data base
- o 1 week to load data files
- o 2 weeks initial force match
- o 2 weeks for force modification and generation of movement requirements
- o 2 weeks to analyze results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per year

USERS: US Army Concepts Analysis Agency, US Army Deputy Chief of Staff for Operations and Plans, US Army Deputy Chief of Staff for Logistics, Organization of the Joint Chiefs of Staff, J-4.

POINT OF CONTACT: MAJ E. R. Montagne, Jr.
US Army Concepts Analysis Agency (JFJ)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1644

MISCELLANEOUS:

- o CAMP is currently being reworked to achieve time and storage efficiencies and provide more documentation. New capabilities are planned to interface DEPREP formatted data.

KEYWORD LISTING: Model; Computer; Force Planning

TITLE: CARMONETTE VI - Computer Simulation of Small Unit Combat

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation

PURPOSE: CARMONETTE VI is a computerized, analytical model designed to simulate small unit battles (up to two battalions per side) with emphasis on unit movement, target detection, weapon firing and assessment of results. The model's chief focus of concern is the assessment of different weapon mixes with different kinds of weapon effects. In addition, it is also concerned with the assessment of the effects of tactics and of sensors and detection devices on battle outcomes.

GENERAL DESCRIPTIONS: CARMONETTE VI is a two-sided model involving land forces and armed helicopters. It is primarily designed to consider units ranging from the individual soldier or vehicle up to units of platoon size. The lower limit of this range may be manipulated to make the smallest group considered as large as a platoon, and the upper limit may be altered to consider up to two battalions. One minute of CPU time is required to game four to six minutes of battle. Simulated time is treated on an event store basis. The model is stochastic, using as its primary solution technique random number determination of success and of time duration for certain events.

INPUT: Troop lists; weapon lists; weapon accuracy; weapon performance data; weapon lethality; sensor performance data; vehicle mobility characteristics; vehicle vulnerability; tactical scenario; terrain characteristics. A total of 35 inputs must be completed.

OUTPUT: Output is in the form of computer printout listing all events assessed, with a summary of all casualty events, and summation of kills by target type and weapon types. Also available are summaries of weapon engagements (firings) shown by target type, rounds fired, personnel and vehicles killed for each of the selected range brackets.

MODEL LIMITATIONS:

- Maximum of 56 weapon types (both sides)
- Maximum of 70 weapon units (each side) with up to 63 killable elements (personnel) per unit
- Max is 63 x 62 grids of selectable size (5m to 250m)
- Does not treat logistics
- Player cannot change tactics during a single game; he must write a new scenario and a new game.
- Results are highly dependent on detailed inputs.

HARDWARE:

- Computer: CDC 6400, or CDC 6000 series, UNIVAC 1108
- Operating System: SCOPE 3.3, EXEC VIII
- Minimum Storage Required: 65K words in memory
- Peripheral Equipment: 3 tape drives, 1 disk

SOFTWARE:

- o Programming Language(s): FORTRAN and COMPASS
- o Documentation: CARMONETTE III: RAC R28, in 3 volumes (Volume I, AD822400L; Volume 2, AD827900; Volume 3, AD825000)
  CARMONETTE IV: The use of CARMONETTE IV in Assessing the combat Effectiveness of Small Units Equipped with Night Vision Devices (in draft; AD514519L)
  CARMONETTE V: Equal Cost Firepower (in draft)
  CARMONETTE VI
- o Both user's documentation and technical documentation are complete, although not available in one document.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2-3 man-months to structure data in mode input format
- o 300 seconds playing time for 50 minute battle
- o 150 to 6-0 seconds CPU time per model cycle
- o 2-3 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS: Principal: ACSFOR, CDC CONFOR GP

POINT OF CONTACT: Mr. E. J. Rose
US Army Concepts Analysis Agency (MRM)
Bethesda, Maryland 20014
Telephone: 202/295-1683

MISCELLANEOUS: CARMONETTE VI supplies assessment data to RAC's Division Battle Model (DBM). CARMONETTE game results are processed by linear regression techniques to generate assessment equations for DBM.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: CAROM - Career Area Rotation Model

PROPONENT: Air Force Human Resources Laboratory, Personnel and Manpower Systems Branch, Occupational and Manpower Research Division (AFHRL/ORS)

DEVELOPER: Decision System Associates, Inc.

PURPOSE: The Career Area Rotation Model is a computerized analytic model that simulates the interaction and impact of numerous policy decisions on optimal tour rotation, manning, career progression, skill upgrading, and attrition for an occupational specialty grouping. The model assesses policy alternatives in terms of tour length, sequence of tour types, grade and skill substitution rules, attrition factors, promotion eligibility criteria, promotion rates, etc.

GENERAL DESCRIPTION: The Career Area Rotation Model is entity level and one-sided, and has both deterministic and stochastic elements. Only Air Force enlisted personnel (after initial technical training) are considered by occupational specialty or grouping of specialties. Simulation is one period (one month or longer) at a time for up to 30 years. A modified Ford-Fulkerson assignment algorithm is used to optimally assign airmen to billets, and a Monte Carlo procedure is used to simulate random processes.

INPUT:

- o Strength requirements for Grades E2 through E9 and for possible skill levels 2-9 for each of four types of tour categories
- o Grade/skill-substitution policy for each tour category
- o Promotion policy and rates
- o Attrition factors
- o Records of new accessions to the career field

OUTPUT:

- o Tabular summaries of all relevant promotion, deployment, accession and attrition activities
- o Output tape of personnel records, including detailed history while on board and final description

MODEL LIMITATIONS: Total manning of an occupational grouping is limited to approximately 100,000 men per simulation period.

HARDWARE:

- o Computer: UNIVAC 1108 and CDC 6600
- o Operating System: Standard
- o Minimum Storage Required: CDC version - 256K bytes; UNIVAC version - 79K words
- o Peripheral Equipment: Tape units, card reader, printer

SOFTWARE:

- Programming Language: CDC Extended FORTRAN and UNIVAC Assembler and FORTRAN V
- User's Documentation: AFHRL-TR-73-49, Career Area Rotation Model
  User's Manual: AFHRL-TR-75-51, Career Area Rotation Model; Supplemental User's Manual

TIME REQUIREMENTS:

- Approximately 1 week to acquire and structure data base in model input format
- 1-15 seconds CPU time per simulation cycle
- Less than 4 hours total computer time for most large occupational groupings

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS:

- AFHRL for development
- AFMPC for operational use

POINT OF CONTACT: Air Force Human Resources Laboratory
Personnel and Manpower Systems Branch
Occupational and Manpower Research Division (AFHRL/ORS)
Brooks AFB, Texas 78235
Telephone: Autovon 240-3222

MISCELLANEOUS: N/A

KEYWORD LISTING: Simulation; Computer Model; Gaming Model; Assignment; Tour Rotation; Policy Assessment

TITLE: C-BASE II - Carrier-Based Air Systems Evaluation Model

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Systems Command (AIR-503)

PURPOSE: C-BASE II is a computerized, analytic, general war model of attack carrier operations against an enemy land-based air arm and target complex. The model operations span only the opening several days of the engagement before either side can replace losses. The model's chief focus of concern is the evaluation of relative effectiveness of different mixes (of fighters, attack or multimission aircraft) for the carriers' complement of combat aircraft systems. C-BASE II is also concerned with the effect of fighter escorts on carrier force total effectiveness and variation in task force effectiveness as a function of assignment rules for multimission aircraft.

GENERAL DESCRIPTION: C-BASE II is a two-sided, mixed model involving land, air and sea forces. It was designed to aggregate fighter and attack aircraft of distinct types, with a range of possible manipulation to include: carrier: at most 4 types of attack aircraft, 2 types of fighters; enemy: 1 type each of fighter and bomber. The model was primarily designed to consider a carrier task force strike group consisting of attack aircraft and escort fighters. It can consider two carriers at most. More than two carriers are possible, but model engagement rules are not appropriate for many carrier task forces. Simulated time is treated on an event store basis. Probability theory and expected value calculations are the primary solution techniques used.

INPUT:

- o Initial number of aircraft by type
- o Their availability
- o Kill probabilities of aircraft targets, airborne and parked on carrier deck or enemy airfields
- o Enemy ground targets other than aircraft
- o Carrier vulnerability
- o Number of operating days
- o Length of operation day
- o Aircraft turnaround time
- o Mean time to repair hits on carriers
- o Number of CAP stations
- o Station time
- o Backup factors
- o Launch abort probability
- o Task force SAM effectiveness

OUTPUT:

- o Computer printout of number of hits on carriers
- o Aircraft kills, airborne and on ground or carrier deck
- o Number of carrier aircraft sorties to weapon release
- o Detailed daily output
- o Summary daily output

MODEL LIMITATIONS:

- o No replenishment of losses, either side
- o Enemy strike against task force not escorted
- o Effectiveness of SAM systems not degraded to reflect strike effectiveness

HARDWARE:

- o Computer: CDC 6600
- o Operating System: NOS/BE 1.0
- o Minimum Storage Required: 51K octal words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Naval Air Systems Command, Systems Analysis Division Technical Report "C-BASE II (Carrier-Base Air Systems Evaluation Model)," Report No. A-503-68-3, October 1969 (DDC No. AD-86463)
- o User's documentation is incomplete.
- o Technical documentation is complete.

TIME REQUIREMENTS:

- o The time required to acquire base data is variable.
- o 1 man-month to structure data in model input format
- o 5 seconds CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2 projects per year - 50 runs per project

USERS:

- o Principal: Naval Air Systems Command

POINT OF CONTACT: Naval Air Systems Command
Systems Analysis Division (AIR-503)
Washington, D. C. 20361
Telephone: Autovon 222-3443

KEYWORD LISTING: Computerized; Analytical Model; General War; Two-Sided; Mixed; Land Forces; Air Forces; Sea Forces; Event Store

TITLE: CEM - Concepts Evaluation Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation

PURPOSE: CEM is a computerized, analytical model designed to portray the course of theater-level, non-nuclear war in terms of FEBA location, condition of opposing forces, and expenditure of resources. The primary problem addressed is that of determining the effects of force structure on force performance in theater-level warfare.

GENERAL DESCRIPTION: CEM is a two-sided, deterministic model involving land and air forces. It is designed to consider groupings as small as a brigade on the Blue side and a division on the Red side, and can aggregate up to the level of a theater army (and air force). Simulated time is treated on a time step basis. The model uses only basic arithmetic and logical operations as its primary solution techniques.

INPUT:

- o Terrain map
- o Military objectives
- o Troop lists
- o TOEs
- o Weapon firepower indices
- o Resupply and replacement rates

OUTPUT:

- o Computer printout stating (periodic) FEBA location, state of opposing forces and resources expended

MODEL LIMITATIONS:

- o Blue brigade structure cannot be changed during a war
- o Reserve units (if any) consist of exactly one of the next lower echelon unit
- o Logistic operations highly aggregated

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Level 31
- o Minimum Storage Required: 150,000 decimal words
- o Peripheral Equipment: 2 tape drives and/or disk

SOFTWARE:

- o Programming Lanaguage: FORTRAN V
- o Complete user documentation but limited technical documentation

TIME REQUIREMENTS:

- 2 months to acquire base data
- 18 man-months to structure data in model input format
- 10 seconds CPU time per twelve-hour cycle
- 2 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 25 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. J. N. Banks
US Army Concepts Analysis Agency (MRM)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1684

MISCELLANEOUS:

- It is presently planned to improve the representation of logistic operations and their effects on combat capability of a force.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: COLLIDE - An Aggregated Conversion Model for Air Combat

PROPONENT: United States Air Force, Studies and Analysis (USAF/SA)

DEVELOPER: United States Air Force, Studies and Analysis (USAF/SA)

PURPOSE: COLLIDE is a computerized analytical model designed to compute airborne interceptor probability of detection and conversion to armament launch position for given target characteristics and tactics.

GENERAL DESCRIPTION: COLLIDE is a one-sided, deterministic model which simulates a one to one airborne intercept. Game time to real time is approximately 1:100.

INPUT:

- o Air-to-air missile launch envelopes
- o Target vector
- o Interceptor vector, "G" available and detection range
- o Heading crossing angle

OUTPUT:

- o Probability of detection and conversion for various approach angles
- o Optimum approach angle
- o Total for random approach angles

MODEL LIMITATIONS: Does not include capability to combine effects of simultaneous radar/IR/visual search.

HARDWARE:

- o Computer: GE 635
- o Minimum Storage Required: 29K

SOFTWARE:

- o FORTRAN IV

TIME REQUIREMENTS:

- o 2 months to assemble data base
- o CPU time: several seconds

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per month

USERS: USAF/SA

POINT OF CONTACT: Assistant Chief of Staff, Studies and Analysis
Hq US Air Force (AS/SASI)
Washington, D. C.
Telephone: OX-54180

KEYWORD LISTING: Analytic; Limited War; Air; Computer Model; One-sided; Deterministic; Event Store

TITLE: COMBAT II

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: The BDM Corporation

PURPOSE: COMBAT II is a computerized model of simultaneous air/ground combat at the theater level with the capability to play conventional, nuclear, or mixed interactions. It is an aggregate model designed to provide an overview of theater level mixed combat exchanges and to determine what is driving the battle outcome.

GENERAL DESCRIPTION: COMBAT II is a differential equations model. Detailed time histories of the combat systems are obtained by numerically integrating a coupled system of nearly a hundred ordinary differential equations. Time histories include the number of remaining units at various locations, targets of every type killed within the system, supply flows, deployments, and attritions due to each enemy source. Systems considered in COMBAT II are ground force units (with a proportionate share of conventional artillery), nuclear artillery, tactical missiles, aircraft, supplies, and nuclear warheads. Model equations are symmetrical for red and blue. Asymmetries are dealt with through data input.

INPUT:

- o Allocation factors
- o Acquisition factors
- o Kill factors
- o Maximum expenditure rates

OUTPUT: The time history of nearly eleven hundred parameters are output on tape. The COMBAT II output tape is input to a post processor program to produce any of the following:

- o Computer printout and plot of the time history of any parameter.
- o Conservation table for any combat system. The conservation table gives a rigorous accounting at each location throughout the battle of units remaining, losses from each enemy source, expenditures against each enemy target, resupply, etc.
- o Decomposition table summarizing throughout the battle the contributions of each combat system to the outcome. The decomposition table and conservation tables enable the analyst to see the contribution of each factor and to identify driving parameters at any point of the battle.

MODEL LIMITATIONS:

- o FEBA movement is considered in three segments (fronts) only.
- o Terrain, weather, day and night effects on target acquisition and movement rates are not calculated explicitly. Provisions are made for accounting for these effects by manual inputs.
- o There are no provisions to represent local breakthrough, overrun, encirclement, and capture.

HARDWARE:

- o Computer: CDC 6000-7000 system
- o Operating System: Local or remote job entry
- o Storage Required: 100K and two on-line files (disk or tape)
- o Peripheral Equipment: Card reader or RJE terminal, printer.

SOFTWARE:

- o Programming Language: FORTRAN (CDC extended)

TIME REQUIREMENTS:

- o Preparation time for a completely new problem is approximately three man-days.
- o Preparation time for a minor excursion on an existing problem is as little as one half hour.
- o Typical run time for a ten-day war (including post processor time) is under two CPU minutes (Run time is somewhat data dependent).
- o Analysis time for output to a completely new problem is less than one day.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used extensively for on-going theater force balance studies.

USERS: The BDM Corporation for DNA

POINT OF CONTACT: Mr. John R. Bode
The BDM Corporation
1920 Aline Avenue
Vienna, VA 22180
Telephone: 703/893-0750

KEYWORD LISTING: Differential Equation; Analytical; Conventional-Nuclear; Ground/Air Forces; Time-Histories; Sensitivity Analysis

TITLE: Combined Arms Combat Developments Activity Jiffy War Game

PROPONENT: Combined Arms Combat Developments Activity

DEVELOPER: Combat Operations Analysis Directorate

PURPOSE: The CACDA Jiffy War Game is a computer-assisted, analytical, general war model which simulates ground combat by computing rates of advance and assessing combat losses due to indirect fire, armor-antiarmor engagements, infantry combat, air defense/armed helicopter engagements and minefields. The model's chief focus of concern is scenario development and analysis of combat force structures at division level and above.

GENERAL DESCRIPTION: Jiffy War Game is two-sided and deterministic and involves both land and air forces. The level of aggregation for which the model was designed is Blue company, Red battalion, with a range of possible manipulation up to corps level. Simulated time is treated on a time-step basis. Ratio of Game Time to Real Time is 4:1 (generally). Interactive wargaming using non-linear assessment equations for combat losses determination is the primary solution technique.

INPUT:

- o Force file (3-level hierarchy)
- o Dynamic interactive game decisions
- o Environmental descriptors

OUTPUT:

- o Interactive feedback (CRT and/or hardcopy)
- o Unit-status file (printed output only)
- o Battle statistics summary (printed output only)
- o Force effectiveness (optional at selected gaming intervals)
- o Unit weapons output (optional at selected gaming intervals)
- o Sector of battle (optional at selected gaming intervals)
- o Opposing weapons array (optional at selected gaming intervals)

MODEL LIMITATIONS:

- o No synergistic weapons effects
- o No specific unit geometry

HARDWARE:

- o Computer: CDC 6400/6500
- o Operating System: SCOPE 4.2
- o Minimum Storage Required: 65K
- o Peripheral Equipment: Remote interactive terminal (secure), line printer

SOFTWARE:

- Programming Language: FORTRAN Extended
- Documentation: 3 Manuals: Technical Manual - 2 volumes: methodology; classified data; appendices; Programmers Manual; User's Manual
- Both user's and technical documentation are complete. All documents submitted for publication May 1977. Estimated date of availability for published documents is June 1977.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 3 man-months to structure data in model input format
- 1 week for each day of corps level battle
- 2 minutes CPU time per model cycle
- 6 months learning time for players
- 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Continual

USERS:

- Principal: Scenario Oriented Recurring Evaluation System (SCORES)
- Other: CACDA, COA

POINT OF CONTACT: Dr. Robert Schwabauer
Combat Operations Analysis Directorate
ATTN: ATCA-CAT
USA Combined Arms Combat Developments Activity
Ft. Leavenworth, Kansas 66027
Telephone: Autovon 552-3193

MISCELLANEOUS: This model supersedes SCORES Jiffy War Game, Manual Jiffy War Game.

KEYWORD LISTING: Computer-assisted; Analytical; General War; Two-sided; Deterministic; Land Forces; Air Forces; Time-Step

TITLE: COMMEL II.5 - Integrated Tactical and Communications Simulation

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Improvements and expansion by US Army Concepts Analysis Agency; originally developed by Philco/CEIR/URS Corps

PURPOSE: COMMEL is a computerized, analytical, general war battle model designed to process input data to develop a battle between division sized forces. Its primary function is to provide the user with a convenient, realistic, dynamic, ground combat environment in which he can observe in detail, as in an actual military operation, the performance of proposed Communications-Electronics concepts and the effects of electronic warfare on communications.

GENERAL DESCRIPTION: COMMEL is a two-sided, basically deterministic model capable of considering units ranging in size from company upwards within a division. Simulated time is treated on a time step basis. Primary solution techniques include probability, queuing and "shortest route" algorithm.

INPUT:

- o Tactical data, including unit locations, weapon effectiveness, intelligence exchange and terrain data
- o Communications systems parameters
- o Message generation parameters
- o Electronic warfare parameters

OUTPUT: Raw data. Tactical and communications post-processing are external to model.

MODEL LIMITATIONS: Computer memory size limitations constrain the complexity and quantity of input data.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 87,000 words
- o Peripheral Equipment: Card reader, printer, tape drives, disk

SOFTWARE:

- o Programming Language: FORTRAN IV, UNIVAC 1108 ASSEMBLY
- o Documentation: COMMEL II User's Manual, Vol I-IV, US Army Concepts Analysis Agency, CAA-D-76-6, Feb 77 (updating in process to reflect EW additions to model)

TIME REQUIREMENTS:

- o Data base acquisition: up to 15 TMM
- o Data structured for input: up to 3 TMM
- o Run times: 15 minutes wall clock incl 12 minutes CPU, for each 1 hour simulated
- o Output analysis: estimated to be 6 man-months, improvements underway

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: TBD

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. J. Clark
US Army Concepts Analysis Agency (SMS)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1541

MISCELLANEOUS: COMMEL II.5 supersedes COMMEL II

KEYWORD LISTING: Simulation; Communications; Stochastic; Division Model; Electronic Warfare

TITLE: COMO III - Computer Modelling System for Air Defence Applications

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: COMO III is a general-purpose critical event modelling system designed to speed the writing of air defence simulations. Already programmed within its framework are many of the features that are common to air defence simulations (aircraft flightpath representation, terrain screening, radar detection, etc.) together with a means of time-ordering the critical events that occur in the simulation. In addition, a special input language (COMIL) and a flexible data retrieval system are provided.

The user develops his own model of each particular air defence weapon system in FORTRAN IV, which is combined with the COMO III framework to produce an air defence simulation model.

GENERAL DESCRIPTION: The COMO III software system consists of four parts:

- o the COMO III frame source program;
- o a library of weapon system models (normally written by the user in FORTRAN IV, utilizing COMO III frame subroutines;
- o the COMO Runtape Assembly Program (CRAP);
- o the COMO Input Language (COMIL).

The purpose of the CRAP program is to add a selected set of weapon system models to the COMO framework, thus producing a COMO III simulation model. A COMO III model is a critical event model, and therefore in the combat simulation process, a subroutine must be programmed for every discontinuity occurring. A form of time-stepping is also adopted to simulate a unit 'waiting' for something to occur, for example a unit trying to detect a target.

The COMIL input language allows games of varying size and detail to be simulated, e.g., one weapon versus one target, up to threatre level conflict involving numerous weapons and aerial targets (current limit is 4096 combat units in the game simultaneously). The total number of combat units in the game can be considerably higher than the number input, because combat units may be created dynamically.

INPUT: Data are input in the form of a COMIL programe which consists of a list of specially named COMIL STATEMENTS. In general, the type of data input by means of these statements can be grouped into two classes: Game Control Data and Combat Unit Data, as described below.

(1) Game Control Data

- o Number of each type of land-based and airborne combat units in the game;
- o Size of the geographic area in which the game is played and resolution required;
- o Combat unit geometry and game entry/exit conditions (x,y,z coordinates, game entry and exit times (if known), initial speed, planned changes in x,y,z and speed during the game);
- o Accuracy and units of measurement to be used;
- o Number of parametric variations required, and parameter values;

- o Number of replications of each game;
- o Type of output required (graphics display, history of each critical event, summary of number of times a particular event executed, etc.).

(2) Combat Unit Data

The amount of input data required to describe a particular combat unit depends upon the complexity of the combat model unit which has been added to the COMO frame. The data requirement is thus fully controlled by the user.

Weapon system models currently programmed in COMO require the following type of input data:

- o Missile/shell characteristics (time of flight versus range, lethality, intercept boundary versus target speed, drag coefficient, thrust history, maximum lateral acceleration as a function of speed and altitude;
- o Interceptor characteristics (drag coefficient, lift coefficient, thrust as a function of throttle setting, speed and altitude);
- o Detection/Acquisition curves (visual/radar/IR probability versus range, or fixed boundary or individual radar characteristics);
- o Reliability (probability of losing target track, missile in-flight failure, incorrect operation by gunner);
- o Logistics (missile/shell stockpile, reload capability);
- o System time delays (times to react, assess target for engageability, reloads, and time frequency of repetitive operations such as glimpse time, radar scan time);
- o Assessment criteria (firing boundaries, range and/or speed estimation statistics);
- o Type of inter-weapon coordination;
- o Visibility data (meteorological visibility, terrain screening patterns, search sectors);
- o Airborne and ground based jammer characteristics (e.g., power, directivity, frequency, bandwidth).

<u>OUTPUT:</u>

- o Computer printout of the number, frequency and distribution of the results occurring at each decision point in the simulation (e.g., number of detections, assessments, target kills, missile failures).
- o The mean and standard deviations of each 'result count' for the number of replications used.
- o A 'TRACE' printout (used for debugging) which causes some or all of the critical events to be listed in time order with the values of weapon system variables at the time each event occurs.
- o More complex scenarios, especially with the interceptor operations model, can be run interactively with a graphical representation of aircraft tracks on a display, and additional printout, if required.

<u>LIMITATIONS:</u>

- o Initial set-up of game requires expertise as a special input language is used (however, once expertise is acquired, the use of special input language can be considered an advantage over other models).

HARDWARE:

- Computer: CDC 3600, CDC 6400, CDC 6600 and UNIVAC
- Operating System: For CDC 6400: SCOPE 3.4
- Minimum Storage Required: 100K octal words or greater according to weapon system and scenario
- Peripheral Equipment: For CDC: Disc and/or tapes

SOFTWARE:

- Programming Language: For CDC: FORTRAN IV, Assembler
- Documentation: *STC TM-162 "COMIL Input Definition Language for COMO III" May 1967 (NU)
  *STC TM-232 "The Addition of Weapon Systems to the COMO Framework" February 1970 (NU)
  STC TM-554 "The COMO III Air Battle Model Program Description" 1977 (NU)

*Currently under revision

TIME REQUIREMENTS: The definition of a weapon system model for use in the COMO framework can take a number of weeks to design and debug, depending upon familiarity with the model. Thereafter simple runs can be set up in a few minutes if the programmer has a working knowledge of the COMIL input language. More complex simulations should take no more than a day to prepare. The results can be interpreted in a few minutes, although the analysis and evaluation can take up to 1 man-week if a lot of parametric or output options are requested.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used daily at STC.

USERS: SHAPE Technical Centre, General Research Corporation (GRC), Concepts Analysis Agency (CAA), Army Missile Command (MICOM), Redstone Arsenal, Selenia Italy, British Aircraft Corporation (BAC), IABG Munich Germany, Thomson CSF France, Fort Leavenworth Kansas, USA.

POINT OF CONTACT: SHAPE Technical Centre
P O Box 174
The Hague
Netherlands
APO New York 09159

MISCELLANEOUS:

- A noise jamming package has been added to the COMO frame. This package allows the user to add noise jamming units or radar units to any combat unit in the game, and assesses whether a particular jammer or set of jammers can influence the detection of a target by a radar. This facility, although completed, is not yet fully debugged.
- A facility to enable the user to interact with the program during a run is also under development.

KEYWORD LISTING: Simulation; Monte-Carlo; Critical Event; Air Defence; Modelling System; Missile System; Gun System; Interceptor Operations

TITLE: CONTACA

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: CONTACA is a computerized, dynamic, two-sided tactical aircraft sortie generator and mission allocator model. From an inventory of air forces, CONTACA generates effective sorties and allocates the sorties to eight possible missions. The model may be used independently or in conjunction with larger, more sophisticated war gaming models.

GENERAL DESCRIPTION: CONTACA is a two-sided, deterministic model involving air forces only. Six aircraft types and eight air missions are simulated per side. The model is designed to consider theater level combat. Allocation of aircraft to the various missions is a direct player input in which is stipulated the percent of each aircraft type dedicated to one or more of the eight missions. Aircraft assigned to the interdiction mission are flown against ten categories of fixed targets established by the player. Simulated time is treated on a time step basis. Probability is the primary solution technique used.

INPUT:

- o Six aircraft types and eight missions per side
- o Standard military capability descriptors
- o Operational factors and attrition rates applicable to individual aircraft types
- o Percent of sorties, by aircraft type, allocated to various missions

OUTPUT: Detailed daily output relative to sortie generation, mission allocation, protective status of parked aircraft (sheltered, in the open and in sanctuary), and the day on which each of the ten categories of interdiction targets are destroyed.

MODEL LIMITATIONS: No damage assessment provided except for aircraft destroyed on the ground.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 20K
- o Peripheral Equipment: FASTRAND format mass storage

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation: Players and Technical Manual, and Program Listings
- o Both user's documentation and technical documentation are complete. The Players and Technical Manual presently exist only in draft form.

TIME REQUIREMENTS:

- o 2 weeks to acquire base data
- o 2 days to structure data in model input format
- o 2 minutes CPU time per model cycle (typical 90-day conflict)
- o 1 week learning time for users
- o 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. T. A. Sanders
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1675

MISCELLANEOUS: This tactical air model was developed, initially, to provide an indication of the influence of a given air concept of operation and mission allocation on the number of direct air support sorties generated by both sides on a day-by-day basis. It was later expanded to provide the target defeat potential of tactical aircraft flying against fixed interdiction type target systems. CONTACA could supply effective sorties figures and mission allocation data to any model that required such input.

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: CREST - Computer Routine for Evaluation of Simulated Tactics

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: CREST is a computerized, analytical model that evaluates the effectiveness of one unit successfully evading one or more adversaries. Although the simulation is presented in terms of a CVA maneuvering to evade a number of nuclear and/or conventional submarines, the model is adaptable to many encounter-evasion situations. The game is designed to examine the survival of a CVA with SONAR screen against a force of submarines. The CVA mission may be to transit through an area or to maneuver in the area. The CVA and the submarines in the model may be given detection and speed parameters similar to other units; for example, merchant ships and surface raiders may be simulated.

GENERAL DESCRIPTION: CREST is a two-sided, stochastic model involving sea forces only. It is capable of considering one CVA versus a maximum of 120 SS/SSNs. Outcomes are assessed semi-rigidly. Simulated time is treated on a time step basis. A 30-hour (100 trials) real time simulation requires approximately two minutes of computer time. The primary solution techniques used are Monte Carlo simulation of decision processes and kinematics for unit motion.

INPUT:

- CVA normal and evasion speeds
- SS/SSN patrol and attack speeds
- Detection ranges
- Kill probability and weapon firing range for SS/SSN vs. CVA

OUTPUT: Time-step battle history, or various levels of summary output are available.

MODEL LIMITATIONS:

- Maximum of 120 SS/SSNs
- The CVA and SONAR screen or escorts cannot kill submarines.
- CVA speed must exceed submarine speed.

HARDWARE:

- Computer: IBM 360/91, IBM 7090/7094
- Operating System: OS 360 (360/91); IBSYS (7090/7094)
- Minimum Storage Required: 32K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "Computer Routine for Evaluation of Simulated Tactics (CREST)," Command Manual, User's Manual, Listings, PAG No. 17-68, CM 3350
- o Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- o 3 days to prepare input
- o Approximately 1 second CPU per model cycle (3 minutes run time for 100 trials)
- o 3 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: OP-96

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step

TITLE: DACOMP - Damage Assessment Computer Program

PROPONENTS: Defense Nuclear Agency (DNA)

DEVELOPER: Engineering Systems Division, Stanford Research Institute

PURPOSE: DACOMP was developed to apply the SEER III single-weapon fallout model to the analysis of full-scale strategic nuclear attacks. The program was designed to determine the radiological fallout effects on population centers and to assess damage in terms of fatalities and casualties. DACOMP has been used in a damage assessment exercise involving an attack of 1,261 nuclear weapons against 3,615 population resource points in the United States. The program was run for three different attack dates. Although the computer program was designed for strategic nuclear studies at the national level, it can be applied to tactical nuclear studies over a more limited area.

GENERAL DESCRIPTION: DACOMP is a dynamic simulation model using the falling rates of representative particles and the winds aloft over the study area to determine the transport and final deposition of radioactive debris from nuclear bursts. The program accepts wind data from up to 100 weather observation stations and generates the wind field over the entire area of study for four observation times. The fallout dose received at each resource center from all weapons is determined, and, using the distribution of population with various shelter protection factors, the program computes the expected number of fatalities and casualties.

INPUT:

- o Population resource data
- o Weapon laydown
- o Wind data
- o Shelter protection factors

OUTPUT:

- o Outside dose for each resource center
- o Number of fatalities and casualties for each resource center
- o Number of fatalities and casualties for each state
- o Total number of fatalities and casualties nationwide

MODEL LIMITATIONS:

- o 10 shelter distributions
- o 4 wind observation times
- o 12 wind levels
- o 10 weapon types

HARDWARE:

- o Computer: CDC 6400
- o Operating System: Batch
- o Storage Required: 45K
- o Peripheral Equipment: 1 tape file for resource data is required, a second tape file for weapon data is optional, three scratch files

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "Computer Routine for Evaluation of Simulated Tactics (CREST)," Command Manual, Users Manual, Listings, PAG No. 17-68, CM 3350.
- o Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- o 3 days to prepare input
- o Approximately 1 second CPU per model cycle (3 minutes run time for 100 trials).
- o 3 days to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: OP-96

POINT OF CONTACT: Mr. Charles G. Frankhauser
Planning Analysis Group
John Hopkins University
Applied Physics Laboratory
8612 Georgia Avenue
Silver Spring, Maryland 20910
Telephone: 589-7700

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step.

TITLE: DADENS-C^2 - Divisional Air Defense Engagement Simulation - Command and Control

PROPONENT: U.S. Army Air Defense School/Directorate of Combat Developments (USAADS/DCD)

DEVELOPER: BDM Services Company

PURPOSE: DADENS-C^2 is a computerized, analytical, general war and damage assessment/weapons effectiveness model designed to simulate either one-sided or two-sided war games. It investigates the effectiveness of offensive and defensive force command and control systems. The focus of this model is command and control. Elements are included to provide either a realistic battlefield environment within which the command and control systems must operate, or a means of measuring the effectiveness of alternative command and control systems. Weapon systems are represented in sufficient detail to realistically represent their operation and to make significant changes in their characteristics meaningful in the outcome of results.

GENERAL DESCRIPTION: DADENS C^2 is a two-sided, stochastic model involving land, air, sea, or paramilitary forces. The level of aggregation for this model is one on one (one fire unit - one threat vehicle). It can simulate the operation of alternative air defense command and control systems, and investigate in detail complex situations involving the interactions between: (1) offensive and defensive forces; (2) offensive forces and the environment; (3) defensive forces and the environment; (4) command and control and the environment; (5) command and control and defensive forces. The level of model exercise is one numbered UTM grid zone. The model was primarily designed for 444 defense entities, 28,665 offensive objects, and 2,047 communication lines with a range of possible manipulation to include any combination of offensive and defensive systems. Simulated time is treated on an event store basis. The DADENS-C^2 is a fully rigid computerized war game. The model is event-stepped and uses Monte Carlo techniques to determine the results of events which influence future events.

INPUT: The analyst prepares the attack plan by inputting specific aspects such as:

- Threats identifiers
- Launch times
- Hostile burst times and locations
- Turn points
- Velocities
- Nodes representing command control center, relay stations, switches, etc.

OUTPUT: A history of all defensive and offensive actions and the results of all defensive and offensive interactions are recorded. Two generic types of output are produced: (1) summary reports, and (2) sorted lists of messages. The analyst can obtain a few concise summaries of results, or a complete list of each action with any level of detail.

MODEL LIMITATIONS:

- Area of play - on UTM grid zone
- Defenses - 63 (444 per defense)
- Offensive cells - 4,095 (7 objects per cell)

o SAM system types - 63
o FI types - 7
o FI base types - 63
o Sensor types - 63
o ABM system types - 63
o Threat types - 31

HARDWARE:

o Type of Computer: CDC 6000 series
o Operating System: SCOPE 3.4 Compiler
o Minimum Storage Required: 147K words of octal storage
o Peripheral Equipment: Disks, magnetic tapes and internal system packs

SOFTWARE:

o Programming Languages: FORTRAN and ASSEMBLER
o Documentation: BDM's version of FORTRAN. This is converted to FORTRAN and ASSEMBLER by BDM's SST translator. No documentation on translator.
o Documentation is not complete. User's documentation is incomplete, and technical documentation is partially documented.
o This model is still in its testing stages and has not been used to support a study.

TIME REQUIREMENTS:

o 4 months to acquire base data
o 2 man-months to structure data in model input format
o 1 to 4 hours CPU time per model cycle, depending on detail of scenario
o Learning time is variable as to player's responsibility
o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Still in test

USER: U.S. Army Air Defense School/Directorate of Combat Developments-SW

POINT OF CONTACT: Pete Bogue, BDM 821-5241 (through Washington Switch)
Joe Masson, USAADS, Autovon 978-4917
Jackie Pittard or Juan Cabrales, USAADS, Autovon 978-5712

MISCELLANEOUS: It is planned to add to this model the capability to computerize input data, damage assessment, etc.

KEYWORD LISTING: Analytical; General War; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Sea Forces; Paramilitary Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: DASH III - A computerized system for performing detailed assessments of the hazards of nuclear attacks - third update

PROPONENT: Defense Civil Preparedness Agency (DCPA)

DEVELOPER: DCPA with System Sciences, Inc. (SSI)

PURPOSE: The Dash system has been designed and implemented for the primary use of analysts and planners who seek to perform comparative evaluations of the effects of all types of nuclear attacks under various conditions. The purpose is to provide the analyst with a system for obtaining both detailed and aggregate assessments for all weapon effects upon any grouping of population, shelters, and associated survival systems, or any other items for which data exist.

GENERAL DESCRIPTION: DASH III employs commonly used algorithms for blast, fallout and fire effects from nuclear weapons. The number and size of attacks, weaponry, items to be assessed, targeting philosophy and environmental conditions--winds and weather--are selected by analyst. Fallout shelter generation and shelter allocation, movement to shelter with constraints from late warnings, may be handled automatically. The system is highly modularized and operates under an executive control system. The analyst may select the modules (subsystems) to be employed in the solution of a particular problem. Certain investigations, such as shelter alternatives, may be conducted during later stages of the computer run without reprocessing previous weapon, environment, and population data or weapon effects computations. The system is able to handle simultaneously several attack sizes, attack variations, and population time frames.

INPUT:

- o Resource points - population, military or industrial facilities, etc. Data may include detailed vulnerability parameters for each point, or a generalized vulnerability by target class may be assumed.
- o Weapon parameters - yield, fission ratio, height of burst, reliability, and delivery error. Weapon aim points may be specified point by point, or generated automatically by targeting subsystem for one or more attacks.
- o Specification of modules to be employed - one of several fallout model options or variations, shelter allocation or movement to shelter routines.

OUTPUT:

- o Detailed point, regional, or national effects summaries
- o Comparison of effectiveness of various shelter options

MODEL LIMITATIONS:

- o 30 attacks handled simultaneously
- o 31 weapon categories
- o Limitation of shelter points in movement area - number changes dependent upon various parameters

HARDWARE:

- o Computer: CDC 3600 - 3800
- o Operating System: SCOPE
- o Storage Required: 64K
- o Peripheral Equipment: 5 tape drives, card reader, hard copy device, optional fallout graphics device

SOFTWARE:

- o Programming Language: JOVIAL J3
- o Documentation: The Dash System - 4 volumes, October 1971, available from Defense Civil Preparedness Agency

TIME REQUIREMENTS:

- o Prepare Data Base: Man-day to man-month
- o CPU Time Per Cycle: 4 hours minimum
- o Data Output Analysis: man-day to man-month

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As needed

USER:

- o Principal: Defense Civil Preparedness Agency

POINT OF CONTACT: Mr. George N. Sisson
Defense Civil Preparedness Agency
Hazard Evaluation and Vulnerability Reduction
Division Research
The Pentagon
Washington, D. C. 20301
Telephone: 202/694-1858

KEYWORD LISTING: Analysis; Attack; Blast; Computerized; Damage; Fallout; Fire; General War; Limited War; Nuclear; Shelters

CURRENT STATUS: This system is currently under study to determine the level of effort required to implement DASH on a UNIVAC computer system which the Defense Civil Preparedness Agency has purchased.

TITLE: DCAPS - Dual Criteria Aimpoint Selection Program

PROPONENT: Defense Nuclear Agency (VLWS)

DEVELOPER: Science Applications, Inc.

PURPOSE: DCAPS is a computer program used to select single weapon aimpoints. It simultaneously maximizes the damage to targets and minimizes damage to designated non-targets. It can also be used to evaluate target/non-target damage from an input aimpoint (DGZ) data base. A necessary condition for aimpoint selection is that the damage specifications on the primary target be met. In all cases, the aimpoint which kills the target and minimizes damage to nearby non-targets is given. In many cases, alternative aimpoints are also given which maximize damage to nearby secondary targets while simultaneously killing the primary target and limiting damage to non-targets.

GENERAL DESCRIPTION: DCAPS is a deterministic model using standard target damage evaluation procedures. It determines a lethal aimpoint region (LAIR) within which the primary target kill criteria are met. It then searches this region for desirable aimpoints based on user supplied damage criteria. Several alternatives are available for damage specification. Up to 500 targets/non-targets can be processed as a group. Up to 50 weapon types (combinations of yield, accuracy, and height-of-burst) can be considered.

INPUT:

- Weapon list (yield, accuracy, height-of-burst)
- Target kill requirements
- Non-target survival requirements
- Program control options
- Target/non-target data base
- Optional strike file data base
- Optional secondary weapon list

OUTPUT:

- Selected aimpoints
- Damage to targets
- Damage to non-targets
- Damage to other installations

MODEL LIMITATIONS:

- Fixed targets
- 500 installations
- 50 weapon types
- Single weapon aimpoints

HARDWARE:

- Computer: IBM 360, Honeywell 6080, UNIVAC 1108, and DEC 10 systems
- Storage Required: 50 K words decimal
- Peripheral Equipment: Hard copy device

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: DCAPS Program Final Report, July 1975

TIME REQUIREMENTS:

- o Data Base: a few minutes if data files are available
- o CPU Time: about 15-20 seconds per aimpoint on UNIVAC 1108
- o Data Output Analysis: user dependent

SECURITY CLASSIFICATION: Confidential

FREQUENCY OF USE: Used extensively at SAI and other DOD organizations

POINT OF CONTACT: Captain John Anderson
Headquarters, Defense Nuclear Agency (VLWS)
Washington, D. C. 20050
Phone: (703) 325-7403

MISCELLANEOUS: DCAPS is under active development. Planned improvements include updated damage methodology, a simple fallout model, and an interactive timesharing version.

KEYWORD LISTING: Dual Criteria, Analytic, Damage Evaluation, New Guidance, Fixed installations, Targets, Non-targets, Evaluation, Aimpoint Selection, Designated Ground Zero.

AD-A050 320 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON D C F/G 15/7
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TITLE: DIVLEV - Division Level Wargame Model

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: DIVLEV is a computer-assisted, analytic, general war model which moves units, determines engagements and attrition, and updates unit strengths and logistics. The DIVLEV model was developed to produce realistic tactical situations that contained unit movements and attrition as a function of time. These situations are used in the evaluation of various materiels and evaluations of weapon mixes and tactics.

GENERAL DESCRIPTION: DIVLEV is two-sided and deterministic, involving both land and air forces. It was designed to consider battalion level with a range of possible manipulation to include company for maneuver units or battery for artillery units. The largest formation level for which DIVLEV was designed is a division, with a range of possible manipulation up to Army brigade. Simulated time is treated on a time step basis. Ratio of Game Time to Real Time is 1:8. The model's primary solution technique is game theory.

INPUT:

- Tactical scenario to include initial situation and unit objectives
- Weapon data to include range, rate of fire, crew size, weight of ammunition, and range dependent kill rates
- Terrain statistics
- Unit data to include position, equipment strength and maneuver instructions
- Vehicle speeds

OUTPUT:

- Plots showing unit positions
- Unit data to include position, strength, and interaction with opposing units
- Killer - victim scoreboard
- The time interval for any of the output can be specified by input codes

MODEL LIMITATIONS:

- The model does not play fixed wing aircraft internally or fixed wing air-defense
- Digitized terrain is not included
- Logistics are kept on the entire unit and not the individual weapon

HARDWARE:

- Computer: BRLESC
- Operating System: Batch
- Minimum Storage Required: 125K
- Peripheral Equipment: Disc storage, CALCOMP Plotter

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Model description is available
- Both user's documentation and technical documentation are complete and are available from developer.

TIME REQUIREMENTS:

- 3 man-months to acquire base data
- 1 man-month to structure data in model input format
- Overall game play: 1:8 game time to play time
- Computer time: 2:1 game time to computer time
- 2-3 hours learning time for players
- Most analysis can be done concurrently with game play

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 1-2 games per year (50-100 runs per year)

USERS: US Army Materiel Systems Analysis Activity

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-T (Tony Rouse)
Aberdeen Proving Ground, Maryland 21005
Telephone: Autovon 283-2900
301/283-2900

MISCELLANEOUS: This model is linked to AMSAA Target Acquisition Model (TAM), and Artillery Force Simulation Model (AFSM)

KEYWORD LISTING: Computer-Assisted; Analytic; General War; Two-Sided; Deterministic; Land Forces; Air Forces; Time Step

TITLE: DIVWAG - Division War Game Model

PROPONENT: Combined Arms Combat Developments Activity

DEVELOPER: Combat Developments Research Office, Computer Sciences Corporation

PURPOSE: DIVWAG is a player-assisted, analytical, general war model. Based upon game orders to the units, the model performs the firepower, mobility, target acquisition, and combat service support functions. The chief focus of concern is the evaluation of a division sized force at a level of resolution which will permit determination of the impact on force effectiveness of changes in mixes of weapons and other systems. In addition, the model considers available logistical support and other combat and combat service support functions, to include Army and Air Force air support.

GENERAL DESCRIPTION: DIVWAG is a two-sided model having both deterministic and stochastic features. Land and air forces are simulated. The model is primarily designed to consider units ranging in size from a maneuver battalion task force to a division. The lower limit of this range may be manipulated to consider a maneuver company team. Simulated time is treated on an event store basis. The ratio of game time to real time is 1:3. Probability and analytical algorithms are the primary solution techniques used.

INPUT:

- Terrain and weather data
- Weapons and equipment characteristics
- Weapons effects data
- Decision tables for establishing priorities for fires and levels of attack
- Consumption rates
- Unit TO&Es
- Task organization

OUTPUT:

- For each period: a set of computer printout reports which provide the information essential for accomplishing the period turnaround.
- For a game: raw data requiring analysis in summary, tabular form.

MODEL LIMITATIONS: Doe not portray dismounted riflemen in ground combat. Communications are not simulated. Total number of units for both sides is 1,000. 200 items of equipment are played for each side.

HARDWARE:

- Computer: CDC 6500
- Operating System: SCOPE 3.4.2
- Minimum Storage Required: 3 million words
- Peripheral Equipment: 1 disc drive, 3 tape drives, card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN, COMPASS
- o Documentation published on 15 August 1972. An updated version is available dated April 1973. A User's Manual, a Technical Manual, and a Programmer's Manual are provided with the documentation.

TIME REQUIREMENTS:

- o 3 months to acquire base data
- o 15 man-months to structure data in model input format
- o 60 calendar days playing time for 48 hours of continuous combat
- o 1.7 hours CPU time per 2 hours of combat
- o 6 months learning time for players

SECURITY CLASSIFICATION: CLASSIFIED

FREQUENCY OF USE: 2 times per year

USERS: Not applicable

POINT OF CONTACT: COL J. Beil
Chief, Scenario and War Games Division
USA CACDA, ATCA-SW
Fort Leavenworth, Kansas 66027
Telephone: Autovon 552-3957
913/684-3957

MISCELLANEOUS: DIVWAG superseded DIVTAG II.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Computer-Assisted; Two-Sided; Mixed Deterministic/Stochastic; Event Store

TITLE: DYNTACS-X - Dynamic Tactical Simulator - Extended

PROPONENT: Combined Arms Combat Developments Activity

DEVELOPER: Systems Research Group, Ohio State University

PURPOSE: DYNTACS-X is a computerized, dynamic combat simulation capable of portraying units up to battalion size. It produces damage assessment by conducting a Monte Carlo battle. Terrain, intelligence, maneuver, weapons systems (both direct and indirect fire), command and control, and others are all considered within the model. DYNTACS' chief focus of concern is weapon system and combat mix evaluation. This is done by analysis of the interplay between weapons systems, terrain, command and control, communications, etc. DYNTACS is modular and has the flexibility to apply pertinent subroutines to specific situations.

GENERAL DESCRIPTION: DYNTACS is a two-sided, stochastic model involving land and limited aerial platform forces. It is restricted to considering individual vehicles unless major reporgramming is done. These vehicles may comprise up to a battalion or a task force. Simulated time is treated on an event store basis. Probability is the primary solution technique used. The ratio of game time to real time is approximately 1:1.5 for battalion level simulation on an IBM 360/91 or 370/165.

INPUT:

- Detailed parameters to define each weapon system portrayed
- Number of vehicles, crew-served weapons, and artillery tubes
- Digitized terrain data, detailed analysis of terrain, human factor times, etc.

OUTPUT:

- A force strength organization table describing information types as to attacker, defender with position coordinates, type of weapon, speed and proposed objective.
- Line of sight tables indicating intervisibility between all elements' movements.
- Movement, intelligence and firing information for each type of contact an element makes with another element.
- Periodic summary of casualties, and a final summary of all firing events from all elements with detailed information describing the outcome.
- All output formats can be varied as required. The event listing can be set to produce listings at any time period. Currently, event listing is set to record every 30 seconds if an event has not occurred.
- Special analysis output to provide summaries of specific data elements for a particular supported study.

MODEL LIMITATIONS:

- o Cost of running
- o Preparation time
- o Complexity of logic
- o Cannot portray dismounted infantry or personnel casualties

HARDWARE:

- o Computer: IBM 360/91 or 370/165
- o Operating System: HASP
- o Minimum Storage Required: 1000K
- o Peripheral Equipment: Disc storage unit, 1 tape drive, 1 printer

SOFTWARE:

- o Programming Languages: FORTRAN IV, data in Assembler Level F
- o Documentation is in 12 volumes with the following AD numbers: 409899, 427793, 447494, 471302, 801900, 815023, 850367, 864919, 864920, 864922, and 864923. Additional volumes essential to complete understanding are AD 604693, 471300, 471301, 366070(S), 378607(C).
- o Both user's and technical documentation are quite complete for the size of the model. There are areas where the documentation is being improved.

TIME REQUIREMENTS:

- o 3 months to acquire base data
- o 3 man-months to structure data in model input format
- o 25-45 minutes CPU time per model cycle (scenario dependent)
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: CLASSIFIED

FREQUENCY OF USE: 1 study per year

USERS: MICOM, USACACDA

POINT OF CONTACT: Mr. David Farmer
USACACDA, Combat Operations Analysis Directorate, ATCA-CAT
Ft. Leavenworth, Kansas 66027
Telephone: Autovon 552-3193

KEYWORD LISTING: Stochastic Model; Damage Assessment/Weapons Effectiveness; Helicopters; High Resolution; Computerized; Battalion Level

TITLE: ESCAP/6

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Systems Command (AIR-503)

PURPOSE: ESCAP/6 is a computerized, analytical, general war model which evaluates the joint effectiveness of several fighter systems (aircraft, radar, missile) in coordinated operations in strike escort or beachhead CAP. The model is concerned with the performance of the fighter group in detecting the threat and, once the threat is detected, the effectiveness of the fighter group in air-to-air combat. The two sections of the program may be run separately.

GENERAL DESCRIPTION: ESCAP/6 is a two-sided, mixed model which involves air forces only. It aggregates fighter and threat aircraft, each of a distinct type, with a range of possible manipulation to include up to 10 fighter aircraft. Simulated time is treated on an event store basis. Monte Carlo simulation (detection performance) and Markov chain computations (combat effectiveness) are the primary solution techniques used.

INPUT:

- o Weapon system type
- o Radar scan pattern
- o Fighter aircraft flight pattern
- o Threat aircraft radar cross section
- o Altitude and speed of escort and threat
- o Escort aircraft grouping
- o Number of missiles for each fighter and threat aircraft
- o Missile launch sequence

OUTPUT:

- o Strike escort: radar detection contour map, survive/kill probabilities, probability distribution of number of unexpended missiles on survivors
- o CAP: joint radar detection performance, number of missile launches by the first CAP making a detection
- o A summary output for the detection portion of the program is available which gives mean detection range and standard deviation.

MODEL LIMITATIONS: For the strike escort case in the detection portion of the model, the speed of the threat aircraft cannot exceed that of the strike group.

HARDWARE:

- o Computer: CDC 6600
- o Operating System: NOS/BE 1.0
- o Minimum Storage Required: 100K octal words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: A short description of the program and a list of inputs are available.
- o Both user's documentation and technical documentation are not complete.

TIME REQUIREMENTS:

- o Less than 1 month to acquire base data
- o Less than 1 man-month to structure data in model input format
- o CPU time per model cycle: 10-15 minutes per 100 iterations for detection; 5 minutes for combat effectiveness

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2-3 projects per year

USERS:

- o Principal: Naval Air Systems Command

POINT OF CONTACT: Naval Air Systems Command
Systems Analysis Division (AIR-503)
Washington, D. C. 20361
Telephone: Autovon 222-3490

MISCELLANEOUS: This model supersedes ESCAP/5

KEYWORD LISTING: Computerized; Analytical Model; General War; Air Forces; Two-Sided; Mixed; Event Store

TITLE: EVADE II

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: EVADE II is a computerized, analytic, damage assessment/weapons effectiveness model. The model simulates engagements between an aircraft force and a ground array of gun and missile positions and calculates relative survivability of candidate aircraft types in various threat environments. This program is also useful as a means of obtaining a first order estimate of the practicality of flight paths, adequacy of weapon deployments or as a relative survivability indicator when investigating tactics, techniques, equipments, environmental variations, and other systematic variations of input parameters to the engagement problem.

GENERAL DESCRIPTION: EVADE II is a two-sided, deterministic, time-step model. Systematic sampling is used in the modeling gun error sources.

INPUT:

- Aircraft: Vulnerable area data, flight profile, time-position-velocity history, terrain masking history to ground weapon sites
- Ground Weapons: Number of rounds fired each burst, time pause between bursts magazine capacity, time to reload, trajectory table data, fire control smoothing constant

OUTPUT:

- Expected number of attrited aircraft
- Expected number of ground targets destroyed
- Event histories list key events for each participant
- Unmasking
- Detection
- Entering effective range
- Firing
- Receival of fire

MODEL LIMITATIONS:

- Not dynamic; flight profiles must be preplanned
- No ground vs ground interactions
- No air versus air interactions

HARDWARE:

- Computer: BRLESC, CDC 6600, IBM 360
- Operating System: SCOPE 3.4
- Minimum Storage Required: 80K

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: EVADE II, Evaluation of Air Defense Effectiveness, revised December 1974. VOL I User Manual; VOL II Analyst. Manual, Book 1 and 2.

TIME REQUIREMENTS: N/A

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS:

- o Principal: US Army Materiel Systems Analysis Activity
- o Other: AVSCOM, MERADCOM, FALCON R&D

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-AAS (Mr. Paris)
Aberdeen Proving Ground, Maryland 21005

MISCELLANEOUS: EVADE II is linked to MASKPAS which generates flight paths and intervisibility history for input. AESOPS uses EVADE output for sustained operations. MASKPAS output can be used for EVADE input. EVADE output can be used for AESOPS input. EVADE II supersedes EVADE I.

KEYWORD LISTING: Analysis; Damage Assessment/Weapons Effectiveness; Land; Air; Computerized; Two-Sided; Deterministic; Time Step

TITLE: FASTALS - Force Analysis of Theater Administration and Logistics Support

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation

PURPOSE: FASTALS is a computerized, analytical model that provides an automated force roundout methodology for the Army Staff. The model simulates the workloads which would be generated under the combat conditions in order to identify the troop units needed to make the force self-supporting, taking into account constraints imposed by the player. The model may be used to assess the effects of different user constraints and supply policies in accomplishing the logistics functions.

GENERAL DESCRIPTION: FASTALS is a one-sided, deterministic model involving land forces only. It is designed to consider groupings as small as a company or battalion, although units as small as a team or as large as a division can be considered. The model is treated in fixed steps, usually 10- or 30-day increments, requiring approximately 30 seconds of CPU time for each time period simulated. Network analysis and table look-up are the primary solution techniques used.

INPUT:

- o Logistic network description for the theater of operations
- o Time phased list of combat units, and their combat intensities
- o Logistics tables of stockage, consumption, construction, medical factors, etc.
- o Logistics rules

OUTPUT: Compter printout of time-phased troop deployments, workloads generated, and supply consumption/stockage by time period. Supplemental programs can be invoked to:

- o Provide a detailed description of the flow of supplies through the transportation network
- o Produce multi-item plots of capabilities versus requirements for logistics activities
- o Compare the troop lists generated by several runs
- o Summarize the troop list in various ways

MODEL LIMITATIONS:

- o Typically, only U.S. Forces are used
- o Data base preparation is detailed and extensive

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII (UNIVAC)
- o Minimum Storage Required: 100 36 bit words
- o One disc drive or three tape drives

SOFTWARE:

- o Programming Language: FORTRAN V
- o User Documentation: RAC-R-86, Appendix C, provides a description of the program and provides guidance for the preparation of input data. Several program changes have been introduced which render this document inaccurage, but usable with pen and ink changes.
- o Technical Documentation: None. The computer program has many comments to guide the analyst.
- o Redocumentation effort underway - projected completion, Jan 1978

TIME REQUIREMENTS:

- o The following relate to requirements for a major study effort:
  - o 1-3 months to acquire data base
  - o 6 man-weeks to structure data in model input format
  - o 3 minutes CPU time per model cycle
  - o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 500 times per year

USERS:

- o Principal: Assistant Chief of Staff for Military Operations (DCSOPS)
- o Other: WSEG, TSG, OSD

POINT OF CONTACT: Mr. D. A. Hurd
US Army Concepts Analysis Agency - FDS
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1081

MISCELLANEOUS:

- o ATLAS, CEM or other theater level war game model provides combat data for input. CAMP examines the feasibility of the FASTALS generated deployment list. SIGMALOG may be used to evaluate the detailed logistics function. Semi-automated interface exist or are being built for these models.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Computerized; One-Sided; Deterministic; Time Phased

TITLE: FCIS - Force Cost Information System

PROPONENT: Headquarters, U.S. Army, Office of the Comptroller

DEVELOPER: U.S. Army Management Systems Support Agency (USAMSSA)

PURPOSE: FCIS is a computerized, analytical, politico-military model that provides rapid cost estimates, for planning purposes, for various Army forces, force postures, and changes in force postures. The model provides costs for actual and hypothetical TOE units and for force structures such as theater forces, division force equivalents, to include division, non-division combat and tactical support increments. A capability has been added to this model to provide cost estimates of future weapon system force units (e.g., AAH, XM-1, AN/TPQ36).

GENERAL DESCRIPTION: FCIS is a one-sided, deterministic model involving land forces only. It is designed to consider units ranging in size from a team to a force. Simulated time is treated on a time step basis. Arithmetic is the primary solution technique used.

INPUT: Input consists of the Standard Requirements Codes (SRC's) or Unit Identification Codes (UIC's) for actual force units. Hypothetical structures are presently costed by modifying actual SRC's or UIC's or creating pseudo SRC's identifying equipment by UN items and personnel by MOS and GRADE.

OUTPUT:

- o Output in variable formats is available in hard copy.
- o Data for a selection of SRC's is published in the Army Force Planning Cost Handbook (AFPCH), a by-product of the FCIS.
- o Data for costing future weapon system force units is published as an annex to the AFPCH entitled "Future Systems and Organizations."
- o A conversational capability, via a cathode-ray tube (CRT) display device, allows Army staff analysts direct access to FCIS, making possible rapid response on questions such as the aggregate costs of force structures.
- o Detailed and summary retrievals are available for all units, actual or pseudo, in the data bank. Selective retrievals and summations via hard-copy and CRT output are available on request.

MODEL LIMITATIONS: The model depends upon the SRC's or UIC's of the force units. Pseudo units, once identified by UN, MOS and GRADE can also be costed in standard FCIS format.

HARDWARE:

- o Computer: IBM 370/165
- o Operating System: O. S. Release 21
- o Minimum Storage Required: 150K bytes
- o Peripheral Equipment: Disk drive, tape drives (7 and 9 track), CRT (IBM 3260), printer, and card reader

SOFTWARE:

- o Programming Language: FORTRAN IV, COBOL
- o User's technical documentation is not complete, due to the fact that expansion and refinement of the FCIS is going on continuously. However, brief general descriptions and programmer documentation are available.

TIME REQUIREMENTS:

- o 3 months or less to acquire base data
- o 1 month or less to structure data base
- o 5 minutes or less CPU time per model cycle

SECURITY CLASSIFICATION: Model algorithms are UNCLASSIFIED. In some cases, data and/or output are CONFIDENTIAL or SECRET.

FREQUENCY OF USE: Weekly

USERS:

- o Principal: Department of the Army
- o Other: Contractors, Office of the Secretary of Defense, and allied nations

POINT OF CONTACT: Headquarters U.S. Army
Office of the Comptroller
ATTN: DACA-CAF, Rm 2B679
Washington, D. C. 20310
Telephone: OX5-2065/5
Autovon 225-0265/6

MISCELLANEOUS:

- o The FCIS provides input to the Force Stratification System, the Battalion Slice Model, and a variety of Army Staff exercises. The FCIS also uses some data from the Force Planning Information System (FPIS).
- o FCIS supersedes the Army Operating Cost Information System (AOCIS) and COSTALS.
- o Additional efforts include modification for correlation with Army budgetary factors and costs, and incorporation of a capability for sensitivity analysis, and CRT display of costs.

KEYWORD LISTING: Analytical Model; Politico-Military; Land Forces; Computerized; One-Sided; Deterministic; Time Step

TITLE: Force Mix Model

PROPONENT: Chief of Naval Operations (OP-604)

DEVELOPER: Chief of Naval Operations (OP-604)

PURPOSE: To calculate an optimum mix of US strategic forces to satisfy targeting objectives within a variety of targeting and other constraints such as SALT limits, cost limits, and nuclear material limits. Model can also be used to evaluate the targeting.

GENERAL DESCRIPTION: The model has classified target bases built into the model. It optimally allocates any list of weapons against any combination of the built in target bases. It is a one-sided model of US capability against Red targets but can be made to represent a two-sided exchange, where the first strike is a counterforce strike against the US, by calculating US force survivability externally to the force mix model. Collateral damage to targets not in the objective set, for example, collateral damage to population when targeting military tartets, is not accounted for.

INPUT:

- Weapon characteristics; yield; R/Vs per booster, CEP reliabilities, alert rates, pre-launch survivability
- Weapon system costs; R&E, procurement and operating cost per unit
- Constraints; SNDV limits, MIRV SNDV limits, TRIAD damage requirement, etc.
- Tarteting requirements; required damage levels against specific target sets

OUTPUT:

- Optimum mix of US strategic forces to meet a set of targeting objectives

HARDWARE:

- Computer: CDC CYBER 170
- Minimum Storage Required: Variable to 32K words

SOFTWARE:

- Programming Language: FORTRAN IV
- CDC APEX linear programming package

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: As Required

USER: Chief of Naval Operations, OP-604

POINT OF CONTACT: Mr. Bob Piacesi
OP-604F3
Pentagon, Washington, D. C.
Telephone: OX-70907

KEYWORD LISTING: Strategic; Counterforce; Targeting; Cost; Nuclear Materials

TITLE: FORECAST II

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: FORECAST II is a computerized, analytical model that provides rapid response definition of expected results from an offensive nuclear strike force for player defined strike strategies. The model assesses the effects of nuclear weapon detonated against a discrete aiming point and against targets collocated with the aiming point. The model thereby enables the analyst to assess the differences in damage results based on variances in weaponeering.

GENERAL DESCRIPTION: FORECAST II is a one-sided, stochastic model involving land and air forces. It is designed to consider individual aircraft and/or missiles if the user desires, and can aggregate to any level up to the nuclear air and missile strike force of either side. Simulated time is treated on an event store basis. The primary solution techniques used are expected value, probability, and the DIA Nuclear Damage Assessment Methodology.

INPUT:

- o Standard military descriptors of delivery systems, nuclear weapons and conventional weapons to be simulated
- o Loss rates applicable to delivery systems
- o Target definitions, using elements of the Joint Resource Assessment Data Base (NMCSSC)
- o Target list strike plan

OUTPUT: Detailed and summary daily output, including tabulation of sorties expected, allocation against the strike list, delivery system and weapon losses, and damage to primary and collocated targets. Damage to targets is reflected in a target bank maintained by the model. Data is prepared by the model for use in subsequent applications.

MODEL LIMITATIONS:

- o 20 delivery systems
- o 20 nuclear weapons
- o The model requires the availability of the Joint Resource Assessment Data Base from NMCSSC.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 28K
- o Peripheral Equipment: 2 tape drives and FASTRAND format mass storage

SOFTWARE:

- o Programming Language: FORTRAN V, ASSEMBLER LANGUAGE
- o Documentation consists of a Technical Manual and Program Listings. Both user's documentation and technical documentation are complete and are available from US Army Concepts Analysis Agency.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 1 or more man-months to structure data in model input format
- CPU time per model cycle varies, depending on the size of the problem
- 2 man-weeks learning time for users

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. T. A. Sanders
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1675

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; One-Sided; Stochastic; Event Store

TITLE: FORDET - Force Determination Model

PROPONENT: Department of the Army, Deputy Chief of Staff for Operations and Plans

DEVELOPER: General Research Corporation

PURPOSE: FORDET is a computerized, analytic, general war model. This model generates feasible general purpose force structures and attainable combined forces for the US and its major Free World Allies. The model determines force structures which conform to specified constraints on structure, budget, and US security assistance allocation.

GENERAL DESCRIPTION: FORDET is a one-sided, deterministic model involving land, air and sea forces. The model was designed to consider major mission force elements (active divisions, res divisions, SSNs, escorts, tactical fighter squadrons and carriers) and can consider any level as individual units within model constraint of 250 units. FORDET was primarily designed for land and air forces. Simulated time is treated on an event store basis. Linear programming is the primary solution technique used.

INPUT:

- Force unit cost factors
- Force effectiveness factors
- Planning scenario
- Participating countries and force unit levels
- Constraints on country budgets/force levels
- Planning goals

OUTPUT:

- Computer printout showing the combined forces generated
- Changes in force structure of each country
- Security assistance allocations
- Selective retrievals/storage of different files and all reports available
- 2-case comparison of selected reports from several files
- Columns and rows section of FMPS solution printout

MODEL LIMITATIONS:

- 4 independent planning scenarios/situations, with up to 5 mission areas each
- 25 countries
- 250 unit types
- 50 resource category connections (flows)
- 200 combined force types
- 300 country unit mix constraints
- 200 combined force unit mix contraints
- 99 resource categories and sub-categories

HARDWARE:

- Minimum Storage Required: 57K

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: User's Documentation: Part I
  Technical Documentation: Part II
  Excellent, detailed documentation

TIME REQUIREMENTS:

- o 1/4 months required to acquire data base
- o .2 man-months to structure data in model input format
- o 5-8 minutes CPU time per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: (Not stated)

USERS:

- o Principal: US Army Concepts Analysis Agency
- o Other: None to date

POINT OF CONTACT: US Army Concepts Analysis Agency (JFJ)
ATTN: Mr. Franklin McKie/MOCA-JFJ
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1646

MISCELLANEOUS:

- o FORDET linked to RESOURCE ANALYSIS - input FDM - output VGATES
- o RESOURCE ANALYSIS generates unit cost data for FDM input; VGATES II evaluates combined forces generated by FDM for combat capability
- o FORDET supersedes Alternative Force Generator (AFG) model in the AFFORD system
- o No new capabilities are planned for this model.

KEYWORD LISTING: Analysis; General War; Land; Sea; Air; Computerized; One-Sided; Deterministic; Event Store

TITLE: FORDIM - Force Distribution Model

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

PURPOSE: To assist in the analysis of the relationship between opposing forces over time, but not engaged in combat. The forces on each side are known as Red and Blue forces. Forces on both sides are described in terms of the resources comprising each unit. These resources can be weapons, personnel, indices of combat effectiveness, firepower potential, armor/antiarmor potential, etc. The Blue units are positioned in sectors and in reserve daily in accordance with the user's scenario. Red forces are then positioned in sectors or in reserve in accordance with one of the nine allocation methods. Red unit integrity may or may not be maintained depending on which of the allocation methods is employed. The model is useful to examine various mobilization scenarios of two opposing forces. Analysis is limited to examine various force ratios and changes in force ratios over time.

GENERAL DESCRIPTION: FORDIM comprises two submodels which are two-sided deterministic models of force mobilization over time. It is designed to run on the HIS 6080 in batch. One submodel distributes the Red resources to sectors without regard to unit integrity while the other distributes Red units to sectors which distribution can be trained by unit frontage.

INPUT: The input to the model is a brief description of the theater, scenario data and Force descriptions in terms of each unit's resources, arrival date, frontage and sector assignment. Approximately 98% of the inputs can be automatically selected from the DOD Force Planning Data Base and directly used by the model. This eliminates substantial user preparation of data.

OUTPUT: The output is a daily picture of the theater, opposing forces and the ratios of the resources and resource values.

MODEL LIMITATIONS: The model is constrained to 10 sectors, 150 units on each side and 50 resources per unit.

HARDWARE:

- o Computer: Honeywell 6080
- o Storage Required: 35K

SOFTWARE:

- o Programming Language: FORTRAN Y - HIS

TIME REQUIREMENTS:

- o 10 CPU seconds per 30-day comparison

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS: OJCS/SAGA

POINT OF CONTACT: Studies, Analysis, and Gaming Agency (SAGA)
Organization of the Joint Chiefs of Staff (OJCS)
Pentagon
Washington, D. C. 20301
Telephone: OX5-9003

MISCELLANEOUS: In addition to providing data directly for analysis, the theater laydown can be used as input to the IDAGAM and VECTOR models.

KEYWORD LISTING: Mobilization; Force Ratio; Computer Model

TITLE: FOREWON - Automated Force Planning System

PROPONENT: US Army Concepts Analysis Agency (CAA)

DEVELOPER: General Research Corporation

PURPOSE: FOREWON is a computer-assisted automated planning system designed to assist the Army Staff in its determination of short-range and mid-range requirements for division forces and certain special mission forces, and in its prediction of the capabilities of those forces. The FOREWON system consists of a Preliminary Force Designer (PFD), Combat Simulator (ATLAS), Theater Roundout Model (FASTALS), Objective Force Designer (OFD), and a Force Cost Assessor (FCA). These models are described separately in appropriate sections of this catalog. The system accepts as inputs a set of worldwide situations that call for the presence of application of US military forces, and derives a single objective force competent to achieve desired military objectives should any one of the set of distinct situations arise. The capability of attaining these military objectives can be analyzed within designated constraints such as total dollar cost limits or manpower allocation.

GENERAL DESCRIPTION: FOREWON is a one-sided, deterministic model involving land forces only. It is primarily designed to consider forces at the theater level. Simulated time is treated on a time step basis. Mathematical simulation is the primary solution technique used.

INPUT: See descriptions of the individual component models.

OUTPUT: See descriptions of the individual component models.

MODEL LIMITATIONS: See descriptions of the individual component models.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC 8
- o Minimum Storage Required: See descriptions of the individual component models.

SOFTWARE:

- o Programming Language: FORTRAN V
- o Both user's documentation and technical documentation are complete. See descriptions of the individual component models for details.

TIME REQUIREMENTS: See descriptions of the individual component models.

SECURITY CLASSIFICATION: UNCLASSIFIED or SECRET

FREQUENCY OF USE: The entire system was used, as a system, four times.

USERS: Headquarters, US Army (DCS OPS)

POINT OF CONTACT: Mr. D. A. Hurd
US Army Concepts Analysis Agency (FDS)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1081

KEYWORD LISTING: Analytical Model; General War; Limited War; Logistics; Land Forces; Computer Assited; One-Sided; Deterministic; Time Step

TITLE: FOZ - Footprints by OZ

PROPONENT: Chief of Naval Operations (OP-604)

DEVELOPER: Academy for Inter-Science Methodology

PURPOSE: A computerized, analytical system for creating optimal allocation of MIRV'd SLBMs within capability of delivery vehicle.

GENERAL DESCRIPTION: The Model allocates MIRV weapons to targets to maximize target coverage subject to the constraint that the utility (number of missiles targeted) from each SSBN and/or missile field must be equalized to the maximum extent possible. The model is designed and structured to achieve fast run time and to provide a complete analysis of the given MIRV problem. Input missile performance parameter requirements are such that detailed missile design and performance parameters are not required. FOZ consists of two major programs.

a. FOZAUX. FOZAUX reduces the number of missile combinations that must be analyzed by the model and reduces computer core storage requirements. This reduction is realized by aggregating, or combining, targets into groups that can be represented by a single geographic position for each group.

b. FOZ. The FOZ program analyzes the target and missile location data to determine feasible combinations of targets which might be grouped into footprints. FOZ forms footprints by targeting missiles from the more difficult-to-target patrol areas first and performs an analysis to provide information relating to feasible alternative patrol area - footprint matchups. FOZ also deaggregates the aimpoint data and formats the various printed reports available from the model.

INPUT:

- o Target base (DGZs)
- o MIRV characteristics
- o Footprint size
- o Booster range
- o Launch areas

OUTPUT: Computer printout assigning weapons to targets

HARDWARE:

- o Computer: CDC 6600
- o Minimum Storage Required: 300K storage

SOFTWARE:

- o Computer: FORTRAN IV

Ref: MIRV Footprint Theory Study (U), OP-604, 1 June 1974

TIME REQUIREMENTS:

- o 2000 DGZs Footprinted from 15 potential SSBN patrol areas in about 20 minutes CP time.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 300 runs per year

USERS: Chief of Naval Operations, OP-604

POINT OF CONTACT: Chief of Naval Operations (OP-604)
The Pentagon
Washington, D. C.
Telephone: 697-5743

MISCELLANEOUS: SIRNEM provides DGZs and assesses damage.

KEYWORD LISTING: Analytic; Strategic; Footprint; Computerized; Missile

TITLE: GFE-III - Gross Feasibility Estimator

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Command and Control Technical Center (CCTC)

PURPOSE: GFE-III is a computerized, analytical logistics model designed as a rapid deployment planning tool to produce quick estimates of closure dates for cargo and personnel at multiple destinations. The model will simulate the deployment of movement requirements to various destinations under various time and facility constraints with varying levels of air and sea transportation resources. Thus, it may be used to assist in examining the feasibility of deployment plans and the effectiveness of transportation resources in support of such plans. The model produces day-by-day totals of cargo and personnel arrivals at the various discharge points with the number of days required to deliver each cargo category within each movement requirement. The model attempts to move requirements as fast as possible and does not honor required delivery dates.

GENERAL DESCRIPTION: GFE-III is a one-sided, deterministic model that simulates individual vehicles and individual requirements. However, both vehicles and requirements may be grouped to suit the user's needs, and these groupings can vary in size at the user's option. Numerical analysis is the primary solution technique used. Simulated time is treated on an event store basis.

INPUT:

- Movement requirements
- Ship resources
- Airlift resources
- Attrition of shipping
- Planning factors (land speed from origin of movement to POE, ship speeds, and convoying factors if applicable)
- Link distances in the transportation network

OUTPUT:

- Listings of input data
- Intermediate listings showing the daily status of movement requirements
- Optional output data specified by the user from nine options which are essentially summations of selected portions of the intermediate output
- The foregoing include such data as the utilization of ships and aircraft, air and sea channel movements summaries, airfield utilization (sorties per day), tonnage handled at ports of embarkation and debarkation, and graphic presentations showing the cumulative closure of each movement requirement priority group by mode of transportation.

MODEL LIMITATIONS:

- o 64 movement channels within the configurations of 8 origins
- o 8 each sea and aerial ports of embarkation and debarkation
- o 8 each convoy marshalling areas and convoy dispersal areas
- o 100 ship groups
- o 15 convoy escort groups
- o 30 aircraft types
- o 40 movement requirements per priority group which are unlimited. The latter consist of personnel and cargo categorized as bulk, outsize and nonair-transportable.

HARDWARE:

- o Computers: IBM 360/65; HIS 6080
- o Operating System: OS/MVT (IBM); GCOS (HIS)
- o Minimum Storage Required: 320K bytes (IBM); 97K words (HIS)
- o Peripheral Equipment: Tape and disk drives

SOFTWARE:

- o Programming Languages: FORTRAN IV (IBM); FORTRAN Y (HIS)
- o Documentation: (1) General Description: CSM-GD 37A-72
  (2) User's Manual: CSM-UM 37A-72
- o The above two documents constitute complete user's documentation and are being updated and republished. There is no technical documentation.

TIME REQUIREMENTS:

- o 1 man-week to structure input data in model input format
- o 1 hour CPU time per model cycle
- o 1 man-week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times annually

USERS:

- o Principal: Organization of the Joint Chiefs of Staff (J-4)
- o Other: CINCPAC, CINCEUR, CINCLANT

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon
Washington, D. C. 20301
Telephone: OX7-5464

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Sea Forces; Computerized; One-Sided; Deterministic; Event Store

TITLE: HALL

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: HALL is a computerized, analytical model which allows quick analysis of the survivability of aircraft fleeing an SLBM attack. The model allows multiple aircraft types, multiple SLBM warhead types and trajectories, and a large variety of basing schemes.

GENERAL DESCRIPTION: HALL is an expected value model which sacrifices detail for more rapid analysis and allows examination of all parameters of interest through its various input options. The model uses a set of aircraft bases either defined by input or internally computed, assigns an aircraft bed-down, and generates an attack plan against those bases and the aircraft escaping from those bases. The primary solution techniques used are LaGrange multipliers, linear programming, and probability.

INPUT:

- SLBM weapon variables
- Target (aircraft) variables
- Basing variables
- SSBN variables
- Attack preference variables

OUTPUT:

- Summaries of the assumptions made in the run and the survivability results
- Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- Expected value calculations are performed.
- Pure weapon strategies are computed.
- No complexing of the target structure due to aircraft altitude variations.

HARDWARE:

- Computer: Honeywell 6080
- Operating System: MULTICS (MIT)
- Minimum Storage Required: N/A
- Peripheral Equipment: Standard scratch disk plus permanent disk

SOFTWARE:

- Programming Language: FORTRAN IV.
- Documentation is available.

TIME REQUIREMENTS:

- o 1 minute or less to structure base data in model input format.
- o 5-10 seconds CPU time per model cycle.
- o 1 hour or less to analyze and evaluate results.

SECURITY CLASSIFICATION:

- o The model is UNCLASSIFIED.
- o Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year.

USERS:

- o Principal: OASD(PA&E)
- o Others: CIA, AFWL, GRC

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: OX-59180

KEYWORD LISTING: Aircraft; Survivability; SLBM Attack; Strategic Analysis; Operations Research; Models; Linear Programming; HALL

TITLE: Hospital Model (Medical)

PROPONENT: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences, US Army

DEVELOPER: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences, US Army

PURPOSE: The Hospital Model is a computerized, analytical, resource utilization model that simulates a hospital (up to 1,000 beds) with the purpose of estimating optimum capabilities, modifying TOEs and examining hospitaliza[illegible] requirements in a combat zone more effectively. The model deals exclusively with the operation of a combat zone hospital. It is primarily interested in examining (and pointing out) the critical parameters in a given theater situation. Some specific problems addressed are: (1) optimum evacuation policy for given patient workload; (2) utilization of treaters in different hospital areas; (3) number of X-rays and lab tests given to a patient mix; (4) number of beds necessary for given evacuation policy.

GENERAL DESCRIPTION: The Hospital Model is a stochastic model involving land forces only. It is primarily designed to consider theater level forces, but can handle almost any small group of men. Simulated time is treated on a time step basis. Fifteen days of real time are simulated in one-half hour of computer time. The primary solution techniques used are queuing theory (used throughout the system) and probability (used extensively in referencing patient class data such as recovery times, death rates, etc.).

INPUT:

- Patient class related information (i.e., probability of occurrence, recovery time, treatment time, death rate, etc.)
- Staffing levels in different areas and wards
- Number of beds, evacuation policy, etc.

OUTPUT:

- Utilization of treaters
- Equipment levels (i.e., X-ray plates, etc.)
- Totals for admissions, evacuations, returns to duty, divisions, beds filled, etc.
- Options available are limited to interim printouts, end-of-replication printout (for 15 days), and average of several replications printout.

MODEL LIMITATIONS:

- Maximum of 280 patients in process at one time (ward patients are not included in this limit). This limit may be expanded with extended core.
- Beds classified as belonging to the medical section do not become available to the surgical section when they are needed there.
- Patients are diverted if treater is not available.
- Only 15 different treaters can be considered in each treatment area.
- Maximum of 1,000 beds

HARDWARE:

- o Computer: Control Data 6500
- o Operating System: SCOPE 3.4.4
- o Minimum Storage Required: 145K octal
- o Peripheral Equipment: 8 tape units (or combination of 8 disk/tape files)

SOFTWARE:

- o Programming Language: FORTRAN
- o User's documentation is complete; technical documentation is sketchy.
- o Formats for input data are complete. Some routines are flowcharted.
- o Each routine has a one-page outline.

TIME REQUIREMENTS:

- o 2 man-months to acquire base data
- o 9 man-days to structure data in model input format
- o 20-30 minutes CPU time per mode cycle
- o 2 man-weeks learning time for users
- o 2 man-weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: Assistant Superintendent, Combat Developments and Health Care Studies

POINT OF CONTACT: Assistant Superintendent, Combat Developments and Health Care Studies (HSA-CSD)
Academy of Health Sciences, US Army
Fort Sam Houston, Texas 78234
Telephone: Autovon 471-6430

MISCELLANEOUS: The Hospital Model can be used by itself or it can accept input directly from the patient workload model.

KEYWORD LISTING: Analytical Model; Health Care Delivery; Land Forces; Computerized; Stochastic; Time Step

TITLE: HOVARM - Anti-Armor Helicopter Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: HOVARM is a computerized model used for analysis. It simulates an armed helicopter attack on hard targets, assesses the damage, computes ammunition expenditures, and expected aircraft losses. The chief focus of concern is the amount of ammunition expended by airborne weapons, armor losses inflicted on ground units, and aircraft losses.

GENERAL DESCRIPTION: HOVARM is a two-sided; deterministic model involving helicopter forces only. It is designed to consider from 1 to 10 aircraft against 1 to 20 targets. Simulated time is treated on a time step basis. Expected value is the primary solution technique used.

INPUT:

- o Target must be defined in detail, including coordinates of each tank, AAA gun, etc.
- o Terrain masking for each aircraft pass must be defined.
- o Aircraft expenditures, weapon Pks, and aircraft speeds must be defined.

OUTPUT: Summary end-of-simulation printout of ammunition expenditures by airborne weapons, armor losses inflicted on ground units and aircraft losses.

MODEL LIMITATIONS:

- o Assumes aircraft is under ground control to the point where the target has been selected and identified
- o No FEBA penetration in depth is simulated

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Helicopter Anti-Armor Model, December 1974, USACAA. Available in the Defense Documentation Center.
- o The above is a complete user and technical documentation.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 minutes CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 60 times per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: HOVARM provides input information for the Theater Rates Model of the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Helicopter Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: HOVER - Anti-Personnel Helicopter Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. Latest developments have been in-house.

PURPOSE: HOVER is a computerized model used for analysis. It simulates armed helicopter attacks against personnel targets. It is chiefly concerned with casualties inflicted on group targets by helicopters, helicopters lost, and ammunition expended on target.

GENERAL DESCRIPTION: HOVER is a two-sided, stochastic model involving land and air forces. There is no logical limit to the maximum or minimum size of the units the model can consider, but it is normally used against targets ranging in size from a platoon to a company. Simulated time is treated on an event store basis. Monte Carlo is the primary solution technique used.

INPUT:

- o Weapon firing errors
- o Lethal areas
- o Ammunition load
- o Weapon firing rates

OUTPUT: Printout of expected aircraft losses, expected ammunition expenditures and expecced casualties.

MODEL LIMITATIONS: Maximum of 20 ground AAA weapons

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Helicopter Anti-Personnel Model, December 1974, USACAA. Available in Defense Documentation Center
- o The above represents complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 minutes CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 60 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: HOVER provides input information to the Theater Rates Model of the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: ICM - Infantry Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. Latest developments have been in-house.

PURPOSE: The Infantry Combat Model is a computerized model used for analysis. It assesses ammunition expenditures from infantry weapon systems, as well as casualties from infantry engagements, for both Red and Blue units.

GENERAL DESCRIPTION: The Infantry Combat Model is a two-sided, stochastic model involving land forces only. It is designed to consider a total of three to four platoons. In theory, it could aggregate up to any limit, but the model has never been used with more than four platoon-sized units on each side. Simulated time is treated on a time step basis. The model is basically Monte Carlo, using probability theory where appropriate, with the object of simulating infantry engagements as realistically as possible.

INPUT:

- o Troop strength and organization for both Red and Blue
- o Pk for weapons simulated
- o Firing rates for weapons simulated
- o Objectives for both the attacking unit and defending unit

OUTPUT: Casualties, infantry weapon expenditures of ammunition, and indirect fire expenditures of ammunition in support.

MODEL LIMITATIONS: Will not resolve below platoon level for attacking force.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Infantry Combat Model, December 1974, USACAA. Available in Defense Documentation Center
- o The above represents complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 week to structure data in model input format
- o 3 minutes CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 400 times per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: The Infantry Combat Model provides input information to the Theater Rates Model or the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Computerized; Two-Sided; Stochastic; Time Step

TITLE: IDAGAM II - IDA Ground Air Model II

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Institute for Defense Analyses (IDA)/Command and Control Technical Center (CCTC)

PURPOSE: IDAGAM II is used in theater-level force structure studies of ground and air conventional conflict. For movement and overall attrition calculations, IDAGAM does not use firepower scores, rather a choice to include an antipotential potential method to calculate the value of the opposing weapons. Attrition by weapon type is calculated using the opposing weapons densities, capabilities and allocation of fire.

GENERAL DESCRIPTION: IDAGAM II is a deterministic model of a conventional theater-level air and ground combat between two opposing forces. The geographical structure of the model consists of a series of nonintersecting sectors, each sector consisting of intervals, each of which have a type terrain and posture assigned to them by the user. A region consists of one or more sectors at a specified distance from the FEBA and there is a communication zone for each side located to the rear of the regions.

The model currently plays the following resources. It may, however, be recompiled to alter these dimensions.

- o Sections - from 6 to 75 each with from 15 to 30 intervals
- o Regions - from 2 to 15
- o People - 3 categories: combat, combat support and service support
- o Weapons - up to 12 types, including SAMs and AAAs
- o Divisions - from 6 to 100
- o Supplies - the model plays only 1 type measured in tons; however, separate account is best for aircraft and ground forces.
- o Aircraft - from 10 to 20
- o Airbases - 2 national airbases in each region and 1 notional airbase in the communications zone, thus the model considers airbases at 3 different ranges from the FEBA.
- o Aircraft Shelters - 1 type in up to 10 fixed locations per side
- o Aircraft Mission - consisting of up to 7 primary and 5 secondary missions
- o Air Munitions - up to 9 types loaded on notional aircraft for delivery on close air support missions

IDAGAM is a fixed time-step model usually in days. The user may add, delete, and/or change forces or parameters at the beginning of specified time periods.

The user has a choice from among 8 attrition equations for the air-model interaction, including binomial, exponential and Lanchester and among several methods of computing ground capability.

INPUT: The model needs some 600 input variables and arrays. Each input data card is uniquely identified for input into a base case set of data.

OUTPUT: All output is in the form of computer printouts of user selected summaries:

- o Detailed Report (Used for debugging)
- o Daily Selected Summary Tables
- o Selected Summary Report (1 page)
- o Output data records which can be used by graph routines

MODEL LIMITATIONS:

- o IDAGAM does not simulate a breakthrough type situation.
- o Logistic aspects of the model are very aggregated.
- o Model is expected value vice Monte Carlo which could be argued to be a limitation.

HARDWARE:

- o Computer: HIS 6080
- o Minimum Storage Required: from 55K to 116K of core depending on array limits desired

SOFTWARE:

- o Programming Language: FORTRAN Y

TIME REQUIREMENTS: 6 to 30 CPU minutes per 15 day game

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 150-200 times per year

USER: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency

POINT OF CONTACT: Studies, Analysis, and Gaming Agency (SAGA)
Organization of the Joint Chiefs of Staff (OJCS)
Pentagon
Washington, D. C. 20301
Telephone: OX5-9003

KEYWORD LISTING: Ground Air; Deterministic Computer Model; Theater-Level; Conventional Combat

TITLE: IEM - Helicopter Individual Engagement Model

PROPONENT: US Army Combined Arms Combat Developments Activity

DEVELOPER: US Army Combined Arms Combat Developments Activity

PURPOSE: IEM is a computerized, analytical, damage assessment/weapons effectiveness model used to assess the effectiveness and vulnerability of attack and scout helicopters versus a threat armor and air defense force. IEM was designed as a tool for comparing the effectiveness and survivability of alternative heliborne antiarmor weapons versus an armor battalion with air defense.

GENERAL DESCRIPTION: IEM is two-sided and deterministic, involving both land and air forces. The level of aggregation considers individual Attack Helicopter (AH) and/or scout helicopters versus individual target weapon. The largest formation the model considers is multiple AH teams versus armor-mechanized threat battalion. IEM portrays line of force contact. Larger forces may violate model assumptions. Simulated time is treated on an event store basis. IEM constructs player weapon event timeliness and estimates convoluted response times to compute event occurrence probabilities.

INPUT:

- o Terrain
- o Visibility
- o Threat target density
- o Engagement ranges
- o Player tactics and responsiveness
- o Munitions lethality
- o Helicopter mission abort criteria

OUTPUT:

- o Probabilities of event occurrences
- o Summary of player weapon losses
- o Output may be listed as a function of engagement range increments or aggregated within a predefined engagement range distribution.

MODEL LIMITATIONS:

- o Helicopters always employ pop-up hover tactic.
- o Threat approach velocity is constant.
- o Uniform distribution of threat elements
- o Player weapon events are independent.

HARDWARE:

- o Computer: CDC 6400/6500
- o Operating System: SCOPE
- o Minimum Storage Required: 65K octal words
- o Peripheral Equipment: Card reader, printer, CRT terminal for interactive play

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Planned to be published as an appendix to the AH-IS/ITV Force Structure Analysis (AFSA) Report to be published OA June 1977. Technical discussion of IEM appears in HELLFIRE Cost and Operational Effectiveness Analysis Addendum (U), Volume II, Appendix O, 1 Nov 1975.
- o User's documentation is not complete.
- o Technical documentation is complete.

TIME REQUIREMENTS:

- o 1 months to acquire base data
- o 1 month to structure data in model input format
- o Less than 10 minutes CPU time per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Source Code UNCLASSIFIED

FREQUENCY OF USE: 5-10 times per year

USERS:

- o Principal: US Army Combined Arms Combat Developments Activity

POINT OF CONTACT: Dr. L. Pfortmiller
Combat Operations Analysis Directorate
(ATTN: ATCA-CAT)
US Army Combined Arms Combat Developments Activity
Fort Leavenworth, Kansas 66027
Telephone: Autovon 552-5140

MISCELLANEOUS: IEM probabilities and expected time results provide input to the Sortie Effectiveness Model. IEM output summary directly input to SEM.

KEYWORD LISTING: Computerized; Analytical; Damage Assessment/Weapons Effectiveness; Two-Sided; Deterministic; Land Forces; Air Forces; Event Store

TITLE: INCAM - Integrated Nuclear-Communications Assessment Model

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: BDM Corporation

PURPOSE: INCAM is a computerized, analytical, damage assessment/weapons effectiveness model which will assess the damage to facilities and disruption to the propagation medial resulting from nuclear weapons detonations. The primary problem addressed is C^3 degradation due to nuclear weapons effects.

GENERAL DESCRIPTION: INCAM is a one-sided, mixed, event store model involving land, air and sea forces and designed for theater level C^3 systems. Nodes can vary from one to 2047. It is an event store model using netowrk analysis for its primary solution technique.

INPUT:

- C^3 system description
- Nuclear weapons yield
- Height of burst
- Targets

OUTPUT:

- Event listings
- Drawdown curves
- Map overlays
- Sorts on the event listings

MODEL LIMITATIONS: Purely static model, can only look at snapshots, makes assumptions in modeling the propagation degradation.

HARDWARE:

- Type of Computer: IBM 370/155
- Operating System: Any recent mission of OS
- Minimum Storage Required: 550K bytes
- Peripheral Equipment: Disc and printer

SOFTWARE:

- Programming Language: FORTRAN (90%) Machine Language (10)
- Documentation: MEECN System Simulation. Documentation is not complete.

TIME REQUIREMENTS:

- Variable months to acquire base data
- 1 man-month to structure data in model input format
- 10 minutes CPU time per model cycle
- Variable months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS: Principal: Defense Nuclear Agency

POINT OF CONTACT: Captain F. L. Eisenharth, USA
Defense Nuclear Agency
Washington, D. C. 20305
Telephone: 325-7403

MISCELLANEOUS: Model is not linked to any other model. New capabilities will include the logic associated with C^2 functions.

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Land; Air; Sea; Computerized; One-Sided; Mixed; Event Store

TITLE: INFERS - Interindustry National Feasible Economic Recovery System

PROPONENT: Federal Preparedness Agency, General Services Administration (FPA/GSA)

DEVELOPER: Mathematics and Computation Laboratory - FPA/GSA

PURPOSE: INFERS is a computer oriented input-output system for assisting in the analysis of plans for economic recovery from a major national disaster. Its design was initiated by the need for use in formulating the plan for recovery from a nuclear attack in general war. The chief focus of concern is to select those final demand requirements for the economy which can be feasibly handled by the surviving production capacities, and at the same time best serve national recovery objectives.

GENERAL DESCRIPTION: INFERS is a one-sided, deterministic model that simulates the U.S. economy through its interindustry relationships either as a whole or in terms of individual economic sectors. The model considers 173 economic sectors using the national interindustry input-output table. A maximum of 12 priority final demand components can be processed in any single run of the system. Simulated time is treated on an event store basis. The model employs the economic interindustry input-output analysis techniques and attempts to satisfy initial estimates of final demand requirements according to a designated priority sequence. This attempt is subjected by INFERS to the constraint of available surviving production capacities when the total capacities required to satisfy a priority that final demand exceeds its available capacities. An estimate is computed of the adjustments that could be made to the priority final demands. INFERS computes, on request, additional tables which can be used to assist in determining feasible modifications of final demand patterns which are consistent with the available capacities. The model also computes the manpower and electricity requirements for the patterned final demand, using precomputed coefficients. If the user wishes to know the distribution of the output of any specific sector amongst the 173 purchasing industries, this information can be provided.

INPUT: The model requires an initial estimation of each of the priority final demand requirements and of the total production capacities at the 173 I-O sector level of the system.

OUTPUT: The system produces the following six edited tables through the standard printer: (a) initial final demand requirements, (b) capacity utilization for each priority final demand, (c) initial gross estimates of adjustments to final demand, (d) manpower and electricity requirements, (e) total requirements of the output of specified sectors relating to final demand, and (f) distribution of the output of specified sectors relating to total production requirements. Options are available to produce only needed tables.

MODEL LIMITATIONS:

- **The system is based on the concepts and techniques of economic input-output analysis. Consequently, its limitations are the same as those of input-output analysis itself.**
- **The system presently uses the year 1963, 173-sector level input-output table derived from the U.S. Department of Commerce, Office of Business Economics, 1963 national input-output table.**
- **Maximum of 12 priority final demand components can be considered.**

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Maximum Storage Required: 60K
- o Peripheral Equipment: Data Matrix Tape, UNIVAC 9300 Card Reader and Printer, Honeywell Page Printing System

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation: The Interindustry National Feasible Economic Recovery System (INFERS), TM-257, April 1977

TIME REQUIREMENTS:

- o Time required for initial estimation of priority final demands and surviving capacities depends on user's knowledge and experience in the area.
- o Less than 1 minute of CPU time per run should be adequate.
- o Time required to analyze the results depends on the user's knowledge of input-output analysis and its inherent weaknesses and strengths.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used many times for analysis of interindustry input-output structure.

USERS:

- o Principal: Federal Preparedness Agency
- o Other: Federal non-defense dapartments and agencies with emergency responsibilities

POINT OF CONTACT: MCL/FPA - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory (EDM)
Federal Preparedness Agency, GS Building
Washington, D. C. 20405
Telephone: 566-0912

MISCELLANEOUS:

- o Initial estimation of final demands or surviving capacities must be made through other models (e.g., READY, DITT, etc.)
- o INFERS supersedes POST.
- o The YEAR 1967 input-output table is being prepared to be used by this system, and the table will be at a 176-sector level.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Civilian Population; Computerized; One-sided; Deterministic; Time Step; Economic Recovery

TITLE: Interceptor War Game Model

PROPONENT: Headquarters, NORAD, Aerospace Defense Command (ADCOM/XPYA)

DEVELOPER: Headquarters, NORAD, Aerospace Defense Command (ADCOM/XPYA)

PURPOSE: The Interceptor War Game Model is a computerized analytical general war model designed to determine the most probable results to be obtained by a postulated manned interceptor defense system versus a plausible manned bomber raid threat. It is used to determine proposals for optimum interceptor force sizing and basing. The model contains the five functions basic to a bomber raid and interceptor defense: (1) Move a number of raids of arbitrary size over defined penetration routes; (2) calculate the intersections of the penetration routes with selected radar coverage; (3) search eligible interceptor bases and commit flights against the raids at the earliest possible time; (4) compute the probability of kill results of the successful intercepts by a combination of Monte Carlo and deterministic methods; and (5) return the interceptor flights to the nearest recovery base for turnaround.

GENERAL DESCRIPTION: The Interceptor War Game Model is a one-sided model having a mixture of deterministic and stochastic elements. Only air forces are involved. It is designed to consider bombers, interceptors, bases and radars on an individual basis if desired and can aggregate each up to a maximum of one hundred. Simulated time is treated on an event store basis. Monte Carlo is the primary solution technique used.

INPUT:

- Radar data: Location and altitude and range capabilities
- Fighter/interceptor (F/I) bases data: Location, type and numbers of F/Is on the base
- Interceptor aircraft data: Maximum allowable time to intercept, speeds, turnaround time, fire control system, armament, probabilities of kill for various altitudes and speeds, reliabilities and commitment policies
- Raid information data: Number of penetrators in each raid, timing and raid path

OUTPUT:

- Input parameter listings which establish initial conditions for the run
- Chronological events list giving time of events in minutes and hundredths of minutes from simulation time zero, raid number, raid size, and penetrator velocity; or the number and type of interceptors, their commitment and/or recovery base, the event, results of the event, location and simulation time.
- Summary reports: (1) interceptor summaries; (2) total kill summaries; (3) kill summaries by raid; (4) summaries of activities by raid; (5) summary of interceptor data by raid

MODEL LIMITATIONS:

- o Bases, types of interceptor aircraft, total penetrator aircraft, raids, and legs per raid path are limited only by memory and time available.
- o The command-and-control decision to commit a flight is assumed positive in all cases.
- o North latitude and west longitude are assumed.

HARDWARE:

- o Computer: Honeywell 6060 - 6080
- o Operating System: GCOS
- o Minimum Storage Required: 50K

SOFTWARE:

- o Programming Language: SIMSCRIPT II.5
- o Documentation: Both user's documentation and technical documentation are in preparation.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 man-week to structure data in model input format
- o 5 minutes CPU time per case
- o 1 man-week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuous

USERS: ADCOM/XPY

POINT OF CONTACT: Headquarters, NORAD, Aerospace Defense Command (XPYA)
Ent Air Force Base, Colorado 80912
Telephone: Autovon 692-3717 (Mr. W. R. Fischer)
Area Code 303 635-8911, Ext. 3717

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; One-sided; Mixed Deterministic/Stochastic; Event Store

TITLE: LDB - Logistics Data Base

PROPONENT: U.S. Army Logistics Center (TRADOC)

DEVELOPER: General Research Corporation (formerly Research Analysis Corp.) and Computer Sciences Corporation

PURPOSE: LDB is a computerized, analytic, logistics model designed to provide detailed logistics data for wargaming, force structure analysis, contingency planning and combat development studies. Provide requirements for Army field forces for personnel, equipment, resupply, transportation, and costs.

GENERAL DESCRIPTION: LDB is a one-sided, deterministic model dealing with land forces from company level to theater Army forces.

INPUT:

- o Army Master TOE file
- o Army Master Data file
- o Supply Bulletin 700-20 data
- o Replacement factors
- o Worldwide asset position
- o Ammunition allowances
- o Petroleum consumption rates

OUTPUT: Printout of requirements selected by unit by time element.

MODEL LIMITATIONS: Multiple runs required for dynamic requirements.

HARDWARE:

- o Computer: CDC 6500
- o Operating System: SCOPE
- o Minimum Storage Required: 2 Disc Packs

SOFTWARE:

- o Programming Language: COBOL
- o Documentation limited to program listings; user's guide under preparation

TIME REQUIREMENTS:

- o 1 man-month to structure data base
- o 5 minutes to 5 hours CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 500-1000 times per year

USERS:

- o U.S. Army Logistics Center
- o U.S. Army Training and Doctrine Command

POINT OF CONTACT: U.S. Army Logistics Center
Logistics Data Branch
ATTN: ATCL-OSL
Ft. Lee, Virginia 23801
Telephone: Autovon 687-734 4180

KEYWORD LISTING: Logistics; Model; Computerized Land Forces; One-Sided; Deterministic

TITLE: LOTRAK II - ASW Localization Model (Phase 1 and 2)

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: LOTRAK is a computerized, analytical model that simulates search, detection, classification, localization, tracking, attack and reattack by two helicopters (Phase 1) and two destroyers (Phase 2) against a single submarine, two destroyers with LAMPS against a single submarine, and a VP against a single submarine (Phase 3). The model is primary concerned with ASW missions, destroyer effectiveness, helicopter effectiveness, and weapon effectiveness (ASROC, torpedo). In addition, it also can develop optimum localization tactics for two helicopters (Phase 1), two destroyers (Phase 2), or LAMPS and VP (Phase 3).

GENERAL DESCRIPTION: LOTRAK is a two-sided, stochastic model involving air and sea forces. It can consider either one or two vehicles. Outcomes are freely assessed. Simulated time is treated on an event store basis. Approximately three hours of real-time simulation are simulated in six seconds of computer time. The primary solution technique is kinematic, with probabilistic event assessment.

INPUT: ASW scenario

OUTPUT:

- o Event-by-event history
- o Statistical analysis summary
- o Trial summary

MODEL LIMITATIONS:

- o 2 helicopters and 1 submarine (Phase 1)
- o 2 destroyers and 1 submarine (Phase 2)
- o 2 destroyers with LAMPS and 1 submarine (Phase 3)
- o 1 VP and 1 submarine (Phase 3)

HARDWARE:

- o Computer: IBM 360/91
- o Operating System: OS-360
- o Minimum Storage Required: 350K

SOFTWARE:

- o Programming Language: PL/1
- o Documentation: (1) "ASW Localization Model - LOTRAK II (Phase II), Operations Manual," PAG 41-71, OM 3360
  (2) "ASW Localization Model - LOTRAK II (Phase I), Operations Manual," PAG 36-70, OM 3360

(3) "ASW Localization Model - LOTRAK II (Phase III), Operations Manual," PAG 49-72, OM 3360 and PAG 51-73, OM 3360

- o Both user's and technical documentation are complete for Phase 1, Phase 2, and Phase 3.

TIME REQUIREMENTS:

- o 3 weeks to prepare input
- o Approximately 4 seconds CPU time per model cycle (approximately 8 minutes run time per 100 replications)
- o 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Once

USERS: Strategic Analysis Support Group, OP-96

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

MISCELLANEOUS: LOTRAK II supersedes LOTRAK I.

KEYWORD LISTING: Analytical; Limited War; Air Forces; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: LULEJIAN-I

PROPONENT: Command and Control Technical Center

DEVELOPER: Lulejian & Associates, Incorporated

PURPOSE: LULEJIAN-I is a computerized analytical, general, nonnuclear, warfare model developed for use in making relative assessments of forces, performing force deployment studies and generating information for use in tradeoffs among weapon systems. The outcome of force interactions is determined in terms of FEBA movement and the attritions of weapon systems and personnel.

GENERAL DESCRIPTION: The LULEJIAN-I model is a two-sided, deterministic simulation of integrated land and air combat. Ground force interactions are aggregated at the sector (corps) level, but individual battalions are accounted for. It is a theater-level model, but may be applied without modification to corps-level engagements. To determine attrition and movement of the FEBA, the model uses individual weapons performance potentials and a concept of trading space for survivability; it does not use aggregated measures of effectiveness such as firepower scores. A significant feature of the model is its use of game-theoretic techniques to determine approximately optimal allocations of some of the resources in the theater. The optimization may be two-sided, or the allocations may be fixed by the user. Six national participants may be played for each side, with three types of maneuver battalion per participant. Thirteen weapon types may be represented within each battalion. The model also represents for each side five types of tactical aircraft, which can be assigned to any of six mission areas; six types of artillery; two types of attack helicopters; and two types of ADA weapon systems.

INPUT:

- o Initial force and logistics inventory data, and a schedule of arrivals
- o Geographic and terrain data
- o Logistics systems capabilities and supply consumption data
- o Weapons performance data

OUTPUT: Tape of the values of all important variables used or generated by the model. Report Generator manipulates the information on the tape to provide printed results desired by the user. A wide variety of data can be obtained in available tables which may be selected for printing, e.g., detailed summary and cumulative results.

MODEL LIMITATIONS: The model is limited to specific maximum numbers of unit types, weapon system types and geographic sectors. Memory sizes and running times of the computers expected to be used were considered in establishing the limitations.

HARDWARE: The model has been successfully exercised on CDC 6400, CDC 6500, CDC 6600 and Honeywell Multics computers. The minimum storage requirement is approximately 50K. Peripheral equipment requirements include disc packs and tape.

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: WSEG Report 259, "The Lulejian-I Theater-Level Model"
- o The above document constitutes complete user's and technical documentation

TIME REQUIREMENTS: Acquire base data and structure it in model input format--4 man-months. This time reduced considerably for other than initial utilization of the model, since much of the data will not change for subsequent studies. Also, a data preprocessor is being developed to provide an interface with the OSD data files described in NATO Task Force Action Memorandum 3 (NTFAM-3). The model requires approximately 1.5 seconds CPU time per combat day, if allocations are fixed. Running times can increase substantially when approximately optimum allocations are being generated. Although the times required are dependent on the nature of the game and the optimization desired, some typical games have required from 20 to 40 minutes CPU time. The time required to analyze and evaluate results is dependent upon the range and depth of the analysis.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Newly developed, has not yet been used operationally.

USERS: Anticipated users include SAGA, OASD(PA&E), and WSEG.

POINT OF CONTACT: Defense Communications Agency
Command and Control Technical Center
The Pentagon, Washington, D.C. 20301
Telephone: OX 53521

KEYWORD LISTING: Analytic Model; General War; Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step.

TITLE: MABS - Mixed Air Battle Simulation

PROPONENT: Systems Analysis Division
Plans and Analysis Directorate
U.S. Army Missile Research and Development Command
Redstone Arsenal, AL 35809

DEVELOPER: Stanford Research Institute

PURPOSE: MABS is a computerized, analytical model that provides estimates of the effectiveness of alternative mixes of air defense forces (SAM, gun, and manned interceptors) against a mixed force of hostile aircraft and tactical ballistic missiles. It is primarily designed to provide a capability to simulate battles in which ground-based air defenses and manned interceptors on one side oppose coordinated air and missile attacks by the other side. In addition, it is concerned with the evaluation of alternative tactics, threat responses, rules of engagement, ECM levels, and the effects of defense in various types of terrain foliage.

GENERAL DESCRIPTION: MABS is a two-sided, stochastic model involving land and air forces. It is designed to consider SAM sites, manned interceptors, anti-aircraft guns and threat vehicles on an individual basis if desired and will aggregate up to a maximum of 255 ground sites, 100 manned interceptors, and 800 threat vehicles. Simulated time is treated on an event store basis. Probability theory and numerical analysis are the primary solution techniques employed.

INPUT:

- Weapon system performance parameters, delay times, rates of fire, etc.
- Geographical locations of defense entities.
- Flight paths of enemy aircraft, damage parameters, flight tactics, and engagement doctrine.

OUTPUT: Computer printouts of complete battle history, of results, or statistics of several replications. Selective debug information may also be printed.

MODEL LIMITATIONS:

- 255 ground sites
- 100 manned interceptors
- 800 threat vehicles
- ECM not explicitly simulated but reduced radar performance for ECM environment is an input
- All threat flight paths are two-dimensional (however, see "Miscellaneous," below).

HARDWARE:

- Computer: CDC 6400/6600
- Operating System: SCOPE 3.3
- Minimum Storage Required: 53,300 words for 6400 version
- Peripheral Equipment: Card reader, line printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Documentation is available for MABS VIII-A and B

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 man-weeks to structure data in model input format
- o CPU time per model cycle can range from 10 seconds for an average iteration to 20 minuts for large problems

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Variable

USERS:

- o Principal: ODDR&E (Land Warfare)
- o Other: SRI, U.S. Army

POINT OF CONTACT: Mr. Michael J. Dorsett
U.S. Army Missile Research & Development Command
Redstone Arsenal, Alabama 35809
Telephone: 205/876-2926

MISCELLANEOUS:

- o MABS uses data from the Terrain Simulation and Intervisibility Model (TIP) and the Air-to-Ground Intervisibility Assessment Program (AGIAP) in the form of three-dimensional effects resulting from terrain following flight profiles and line-of-sight.
- o MABS currently includes fire coordination and IFF.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: MACE - Military Airlift Capability Estimator

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Military Airlift Command (MAC)

PURPOSE: MACE is a computerized, analytical logistics model that assists the transportation planner by providing rapid estimates of force closure times, utilizing airlift means. MACE is primarily designed for users who have a requirement to obtain estimates of large-scale troop and cargo movement closure times using military airlift force structure and general planning data.

GENERAL DESCRIPTION: MACE is a one-sided, deterministic model designed to consider single aircraft, individual requirements, and individual APOE-APOD. Aircraft can be grouped by aircraft type. The model works by successive increments and its aggregative ability is consequently limited only by the capacity of the computer. Numerical analysis is the primary solution technique used.

INPUT:

- o Force definitions
- o Aircraft ground time
- o Requirements (including APOE-APOD and distances)

OUTPUT:

- o Schedule of the daily movement capability of the aircraft employed
- o Closure time at the destination of the force being moved
- o Individual requirement traces
- o Aircraft mission traces
- o Aircraft utilization summaries
- o Requirement closure summaries

MODEL LIMITATIONS:

- o Air is the only mode of transportation considered.
- o Aircraft can be prepositioned for the first acquirement only. Thereafter they automatically appear where needed.
- o No time-phased processing of requirements

HARDWARE:

- o Computer: IBM 360/65; HIS 6080
- o Operating System: OS/MVT (IBM); GCOS (HIS)
- o Minimum Storage Required: 300K bytes (IBM); 36K words (HIS)
- o Peripheral Equipment: Magnetic tape and disks

SOFTWARE:

- o Programming Language: PL/1
- o Documentation: User's Manual - CSM-UM 112-70
- o User's documentation is complete. Technical documentation is not.

TIME REQUIREMENTS:

- 1 man-month to acquire base data
- 1-1/2 man-weeks to structure data in model input format
- 30 minutes CPU time per model cycle
- 2 man-weeks learning time for users
- 1-1/2 man-weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 75 times per year

USERS: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon
Washington, D. C. 20301
Telephone: OX7-5464

MISCELLANEOUS:

- MACE passes data to MASS (MACE Special Summaries Program) for summarization.
- MACE generates data for MORMAC (MORSA/MACE Interface Program) to reformat MORSA requirements data.

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Computerized; One-Sided; Deterministic

TITLE: MACRO MODEL 12

PROPONENT: Military Airlift Command

DEVELOPER: MACRO Task Force

PURPOSE: The MACRO Model 12 is a computerized, analytical, logistics (including transport/transsshipment) model evaluating the Military Airlift Command (MAC) airlift delivery system for wartime scenarios using notional locations and aggregate ground support services. The principal focus is the measurement of the total delivery performance of the MAC system reflecting the effects of aircraft queueing anywhere. The model addresses the effects of station denials, air refueling, alternate routing, various fleet mixes and limited ground support.

GENERAL DESCRIPTION: The MACRO Model 12 is a one-sided, stochastic model. It was designed for individual aircraft movements and considers aircraft fleet size, cargo movement requirements, up to 8 aircraft types, up to 4 cargo classes, and subject to 18 notional locations. The primary solution technique used is network simulation using Q-GERT simulation language.

INPUT:

- Applied aircraft (number and type)
- Initial aircraft availability schedule
- Cargo requirements (from-to by cargo class)
- Current configuration of wartime scenario (if different from present configuration)

OUTPUT:

- Flying hour requirements
- Aircraft UTE rates
- Route usage by leg segment
- Aircraft waiting times
- Movement closure time
- Closure by cargo class and aircraft type
- Delivery rate by cargo class
- Location workload
- Number of aircraft queueing by location
- Aircraft handling requirements
- Ground time histograms
- System onload/offload history
- Periodic reports reflecting aircraft and cargo status by location or various time intervals
- Standard Q-GERT output including trace options
- Designed user specified output as desired

MODEL LIMITATIONS:

- All cargo is measured in terms of aircraft loads
- Routing algorithm is completely probabilistic
- Specified locations are aggregated into notional locations
- Aircrew resources are not addressed
- Tanker aircraft are assumed available by the model

HARDWARE:

- o Type of Computer: Honeywell 6080
- o Operating System: GCOS
- o Minimum Storage Required: 77K

SOFTWARE:

- o Programming Language: Q-GERT and FORTRAN
- o Documentation: Available in form of User's Manual, a Q-GERT User's Manual and technical documentation
- o Documentation was prepared for use by an operations research analyst and contains an overview of the model, input and output requirements, FORTRAN flow charts of all user-written subprograms, and a complete listing of the necessary computer files.

TIME REQUIREMENTS:

- o 3 hours to structure data in model input format
- o 30 minutes CPU time for 90-day war scenario
- o 6 hours to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- o Principal: MAC Headquarters
- o Other: N/A

POINT OF CONTACT: Capt Victor J. Auterio
MACRO Task Force
Scott AFB, Illinois 62225
Telephone: Autovon 638-3470

MISCELLANEOUS: Model can be linked to a host of other MACRO models, such as the Aircraft Loading Model, Tanker Air-Refueling Model, and the Aircrew Resource Model. It has a manual linkage relationship and supersedes MACRO Model 11.

KEYWORD LISTING: Analytic; Logistics; Air Forces; Computerized; One-Sided; Stochastic; Event Store

TITLE: MAWLOGS - Models of the Army Worldwide Logistics System

PROPONENT: U.S. Army Logistics Center

DEVELOPER: General Research Corporation

PURPOSE: MAWLOGS is a computerized, simulation logistics modeling system, by means of which a particular model is generated to simulate the activities and measure the behavior of a particular logistics system structure with particular policy and procedure content at a level of detail chosen by the user. Its primary focus of concern is to simulate any of a wide range of alternative logistics system structures, policies and procedures involving maintenance supply, transportation, and communications and their interactions, and to measure characteristic workloads, performance and costs.

GENERAL DESCRIPTION: The keystone of the MAWLOGS system is the model assembler, a program which constructs a simulation model of a system represented as a network of functional nodes whose policy and procedural content are specified in terms of modules (i.e., blocks of computer program logic representing a logistics activity or policy). The model assembly technique potentially reaches well beyond the field of logistics modeling. The level of aggregation may be varied widely, from much to little detail, from troop unit to wholesale activities. Simulated time is treated on an event store basis. The primary solution technique of MAWLOGS is stochastic discrete event simulation. Except for a shortest chain algorithm in the route selection logic of transportation, no optimizing algorithms are in the present module library; but they can be added.

INPUT:

- To model assembler: description of system for which a model is to be generated--in terms of nodes and modules; a module library (on tape or cards)
- To a model: policy parameter settings, resource levels, demand characteristics of supported population, performance characteristics, such as capacities, delay times, and constraints of system elements

OUTPUT: Output is in the form of computer printouts of summary statistics showing totals, averages, maxima, minima, and variances, and histograms. Optionally, a tape file of detailed transaction data susceptible of a variety of post analyses may be obtained. Post processors are available for analyzing the time behavior and the autocovariance, spectral density function, sample size, and statistical confidence of a variety of variables and for developing a variety of costs of the logistics system. A routine to plot graphs on a printer is available.

MODEL LIMITATIONS: The modeling system is open-ended in that the user is free to add any module of interest to the module library. Thus, there is no limitation to the scope of the model. However, modules to be used together must have compatible data structures, which limits the number of feasible combinations that may be formed. There is a small loss in efficiency (i.e., a greater running time) caused by the logic linkage generated by the assembler to make possible the flexibility of model definition described above.

HARDWARE:

- o Computer: CDC 6400 or CDC 6500
- o Operating System: SCOPE 3.4
- o Minimum Storage Required: Variable, from about 20,000 words upward
- o Peripheral Equipment: Card reader, printer, two tape files plus one to five tape or disk files

SOFTWARE:

- o Programming Language(s): FORTRAN
- o Documentation: USASI Standard FORTRAN (CDC FTN Version). May contain an occasional Control Data Corporation 6000 series FORTRAN peculiarity.
- o User's documentation and technical documentation is complete.

TIME REQUIREMENTS:

- o CPU time varies from 1 minute to hours, but one hour has been typical.
- o Approximately 3-6 months to analyze and evaluate results, varying with the problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: General Research Corporation and U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate (ATCL-OSA)
Ft. Lee, Virginia 23801
Telephone: Autovon 687-4180/3403

KEYWORD LISTING: Analytical Model; Logistics; Computerized; Stochastic; Event Store

TITLE: MESM - Multiechelon Supply Model

PROPONENT: U.S. Army Logistics Center

DEVELOPER: General Research Corporation

PURPOSE: MESM is a computerized, analytical, logistics model designed to simulate the supply transactions in multiechelon systems of supply points, inventory control points, and shipment consolidation points; and to report the resulting supply performance, supply and transportation workloads and costs. Its primary concern is to perform comparative analyses of alternative supply systems and to determine their relative merits.

GENERAL DESCRIPTION: MESM involves land, air, and sea forces, and its level of aggregation is designed to be widely variable within a model run: the model can consider groups of units anywhere from battalion to worldwide in scope. Years of time may be simulated in a time period ranging from a few seconds to many minutes per item. Simulated time is treated on an event store basis. The model uses stochastic discrete event simulation as its primary solution technique.

INPUT: Major input requirements are a description of the system to be simulated in terms of nodes and links and their associated characteristics, and a specification of the demand patterns for each item to be considered.

OUTPUT:

- The model produces a detailed system description, reports of transportation workloads by link, and reports of summary performance and workload statistics by node and echelon for each item and for the aggregated items.
- Reports by item are optional. Four Output Data Postprocessors are available to produce reports of inventory and transportation costs, summary workload and performance reports for arbitrary sets of items, histograms and graphs, and statistical estimates of the mean, covariance and spectrum of time series statistics.

MODEL LIMITATIONS: Limited to analysis of supply systems with related transportation and communications. In multi-item runs, the items are simulated independently, one item per pass through simulated time. Model reprogramming and update are in progress.

HARDWARE:

- Computer: CDC 6500
- Operating System: SCOPE 3.4
- Minimum Storage Required: $(151K)_8$ words
- Peripheral Equipment: 3 external files (tapes or disks)

SOFTWARE:

- o Programming Language(s): FORTRAN
- o Documentation: H. A. Markham et al, "A Flexible Simulation Model of Multiechelon Supply, Vol. I: Description and Operating Instructions; Vol. II: Program Descriptions, Flow Charts, and Listings," RAC-TP-442, January 1972, AD 892-640L
- o New user's documentation and technical documentation have been modified and are not yet complete.

TIME REQUIREMENTS:

- o 3 to 6 months to acquire base data
- o Up to 2 man-months to structure data in model input format (NOTE: Above time requirements do not apply if assumed distribution patterns are employed.)
- o CPU time varies from a few minutes to a few hours depending on the application.
- o 2 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: One major study - 100 runs

USERS: Principal: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate (ATC-OSA)
Ft. Lee, Virginia 23801
Telephone: Autovon 687-4180/3403

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces: Sea Forces; Computerized; Stochastic; Event Store

TITLE: Mine Hunting Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: The Mine Hunting Model is a computerized, analytical model that evaluates the effectiveness of a mine field against mine hunting countermeasures. The model evaluates proposed minefields, with the purpose of helping the minefield planner to determine the number and type of mines, ship counts, arming delays, replenishments, mine settings, location of fields, etc., necessary to obtain the desired results against an expected mine hunting effort.

GENERAL DESCRIPTION: The Mine Hunting Model is a two-sided, stochastic model involving sea forces only. It is capable of considering mines and ships on an individual basis if desired, and can aggregate up to a maximum of 300 minelike objects of 60 types, 50 countermeasure ships, and 5 types of traffic ships. This upper limit may be indefinitely extended, however, depending on available computer capacity. Simulated time is treated on an event store basis. Monte Carlo simulation and probability are the primary solution techniques used.

INPUT:

- o Mines and their characteristics
- o Characteristics of mine hunting ships
- o Characteristics of traffic ships
- o Configuration of minefield and channel
- o Type of bottom and amount of clutter
- o Expected schedule of countermeasures and traffic

OUTPUT:

- o Computer printout giving mines detected and neutralized, mines fired, damage to ships, and threat of the minefield as a function of time.
- o The interval at which output is given is variable. Printout of status of entire minefield with other output is optional.

MODEL LIMITATIONS:

- o Computer storage
- o Cost of storage and running time

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE
- o Minimum Storage Required: 50K words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a command manual, programmers manual, and input guide.

TIME REQUIREMENTS:

- o 2 days-week to acquire base data
- o 1 day to structure data in model input format
- o CPU time depends on the length of time simulated and the number of mines involved, e.g., a mine simulation over 30 days with heavy traffic took 500 seconds of CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice per year

USERS: NSWC/DL for COMINWARFOR

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 703/663-7406 or 663-8645

MISCELLANEOUS:

- o The Mine Hunting Model has the option of using the output of the Mine Delivery Model and the Minefield Planning Model

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: NDAM - Nuclear Damage Assessment Model

PROPONENT: Defense Intelligence Agency (DB-4C1)

DEVELOPER: Defense Intelligence Agency (DB-4C1)

PURPOSE: NDAM is a computerized, analytic, damage assessment model, which given a specific laydown of nuclear weapons, assesses probable damage to a given array of installations and personnel targets resulting from "prompt" effects.

GENERAL DESCRIPTION: NDAM is a one-sided deterministic model which will assess one to six possible targeting options in one run of the model.

INPUT:

- o Target latitude, longitude, radius, VNTK, population
- o Weapon DGZ, CEP, HOB, reliability

OUTPUT:

- o Detailed data on each target affected
- o Summary of expected damage by category for each weapon
- o Summary of expected damage by category for each laydown option

MODEL LIMITATIONS:

- o Laydown of 100 weapons
- o When using weapons in excess of 1 MT some affected targets are not included in printout.

HARDWARE:

- o Computer: GE 635
- o Operating System: GEC 053
- o Minimum Storage Required: 80K words

SOFTWARE:

- o Programming Languages: COBOL and FORTRAN
- o Documentation: internal to program
- o DI-550-27-74 "Mathematical Background and Programming Aids for Physical Vulnerability System for Nuclear Weapons."

TIME REQUIREMENTS:

- o CPU - 10 minutes

SECURITY CLASSIFICATION: SECRET RESTRICTED DATA

FREQUENCY OF USE: 20 times per year

USERS: Defense Intelligence Agency

POINT OF CONTACT: Defense Intelligence Agency
Washington, D. C. 20301
ATTN: DI-7D and SO-4A3
Telephone: 692-5148

KEYWORD LISTING: Analytic; Deterministic; Damage Assessment; Nuclear; Computerized

TITLE: NEMO III - Nuclear Exchange Model, Mod III

PROPONENT: Chief of Naval Operations (OP-604)

DEVELOPER: NAVCOSSACT

PURPOSE: NEMO III is a computerized, analytical model designed for use in evaluating the SIOP when gamed against the RISOP. The model addresses the problem of simulating the interaction of strategic nuclear offensive forces contained in the SIOP and RISOP and the opposing defensive forces.

GENERAL DESCRIPTION: NEMO III is a detailed two-sided event store simulation model. It plays individual missiles, RVs, bombers, ASMs, and decoys as programmed in the SIOP and RISOP. The model has both stochastic and deterministic elements, using a combination of Monte Carlo probability theory as its solution techniques. Both sides are played against their respective defense concurrently. Model can simulate the performance of one weapon or several thousand. The two-sided game can be command interrupted to provide intermediate attack execution results.

INPUT:

- RISOP and SIOP
- SAM and ABM sites: location and vulnerability
- Aircraft interceptor bases: location and vulnerability
- Offensive and defensive system performance parameters

OUTPUT:

- AGZ tapes for successful weapons
- Computer listings summarizing results in terms of number of vehicles, weapons, yield of weapons, etc.
- Detailed information on the performance of each weapon and vehicle

MODEL LIMITATIONS:

- The model does not allocate weapons to targets.
- Running time is extensive which limits the number of possible runs.
- Building and maintaining the data base is a major effort.

HARDWARE:

- Computer: UNIVAC 1108/1110
- Operating System: EXEC VIII
- Minimum Storage Required: 64K
- Peripheral Equipment: Drum, Tape, Disc, Printer, Card punch/reader

SOFTWARE:

- Programming Languages: COBOL, FORTRAN
- Documentation: Under preparation

TIME REQUIREMENTS:

- o 2 months to acquire base data
- o 2 man-months to structure data in model input format
- o 6 hours CPU time per model cycle for simulation only; 8 hours for input, 2 hours for output
- o 3 months to analyze and evaluate results from a gaming cycle

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 50-60 cycles per year

USERS: Chief of Naval Operations (OP-604), Studies, Analysis, and Gaming Agency, OJCS

POINT OF CONTACT: Chief of Naval Operations (OP-604)
The Pentagon
Washington, D. C.
Telephone: 697-5743

NARDAC
Code 30
Washington Navy Yard
Washington, D. C.

MISCELLANEOUS:

- o The QUICK Model generates the RISOP battle plan for input to NEMO III. The SIOP is provided by JSTPS.
- o AGZ output used as input to SIDAC Model operated by CCTC
- o Supersedes NEMO II
- o Model operation, support and maintenance requires the full time effort of about 15 skilled personnel.
- o Multiple Engagement Module (MEM) assesses attrition to the ICBM/SLBM portion of the SIOP visible to Soviet ballistic missile defenses and/or directed against defended targets within the Soviet Union.

KEYWORD LISTING: Computerized; Analytic; Two-Sided; Dynamic; Strategic; Nuclear; Missiles; Bombers

TITLE: NEWAIR

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: NEWAIR is a theater-level air battle simulation model which addresses the outcome of a conflict between air forces employing conventional weapons. The model is designed for the evaluation of relative air force capabilities in Central Europe. The model can be used for interactive wargaming, with the players communicating with the program through remote terminals. A completed campaign, conducted interactively, may subsequently be run as a batch job to perform sensitivity excursions.

GENERAL DESCRIPTION: NEWAIR is a deterministic, time step model. It will compute the attrition to attacking and defending aircraft and the damage inflicted on runways, shelters, aircraft on the ground, and terminal defence weapons. The model will also compute the number of sorties delivering ordnance to close air support and interdiction targets. The computations are performed separately for each target attacked, reflecting the weapons and aircraft actually taking part in each engagement.

INPUT: The following are the main inputs to the model:

- o Aircraft performance data for each aircraft type to be played
- o Airbase data
- o Target data (close air support and interdiction targets)
- o CAP pattern data
- o Attrition data

OUTPUT:

- o The program displays an attrition summary at the terminals at the end of each time period simulated
- o More detailed output is printed on the line printer. This includes an airbase report, a CAP-pattern report, and a counter air report

MODEL LIMITATIONS:

- o The number of aircraft types and airbases that can be handled are limited by the core storage available
- o 40 aircraft types and 150 airbases can be handled with 120_8K words

HARDWARE:

- o Computer: CDC 6400
- o Operating system: SCOPE 3.4, INTERCOM
- o Storage requirement: 100_8K words
- o Peripheral equipment: Line printer, at least one terminal

SOFTWARE:

- o Programming Language: SIMULA-67
- o Documentation: No documentation available

TIME REQUIREMENTS:

- o The acquisition of a data base can be fairly time consuming. The coding of the input data in the format required by the model should not take more than 1-2 weeks.
- o CPU time requirement is data dependent, typically 100-200 seconds per cycle (8 hours).

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not in regular use

USERS:

Principal: SHAPE Technical Centre, with military participation

POINT OF CONTACT: SHAPE Technical Centre
P. O. Box 174
The Hague
Netherlands
APO New York 09159

KEYWORD LISTING: Deterministic; Theater Level; Time Step; Air Forces

TITLE: NUCROM - Nuclear Rainout Model

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Stanford Research Institute

PURPOSE: NUCROM was designed for damage assessment studies of the hazard from rainout from nuclear clouds over a wide range of input conditions. It was designed so that the user could choose from a number of assumptions concerning the initial conditions and the physical rainout mechanics.

GENERAL DESCRIPTION: NUCROM is a single burst rainout model that provides radiation exposure rate and exposure dose patterns for a wide range of input conditions.

INPUT:

- o Weapon yield
- o Fission fraction
- o Height of burst
- o Wind direction and speed at various altitudes
- o Precipitation cloud geometry, location, type and duration
- o Activity distribution in debris cloud
- o Scavenging rates

OUTPUT:

- o Rainout arrival times
- o Exposure dose rate pattern
- o Exposure dose pattern

MODEL LIMITATIONS:

- o Single burst model
- o Airbursts only

HARDWARE:

- o Computer: CDC 6400
- o Operating System: Batch
- o Storage Required: 40K
- o Peripheral Equipment: none

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "NUCROM: A Model of Rainout From Nuclear Clouds," DNA 3389F, August 1974
- o Documentation Availability: Limited to U.S. Government Agencies, DDC No. 921975L

TIME REQUIREMENTS:

- o Prepare Inputs: Nominal
- o CPU Time per Cycle: 4 to 10 seconds
- o Data Output Analysis: Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Very limited, i.e., only when rainout effects are being studied.

PRINCIPAL USERS: Stanford Research Institute

POINT OF CONTACT: Mr. Sanford Baum
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: 415/326-6200

KEYWORD LISTING: Rainout; Washout; Tactical Nuclear Weapon Effects; Damage Assessment

TITLE: NUFAM - Nuclear Fire Planning and Assessment Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: NUFAM is a computerized, analytical, limited war model designed to simulate a nuclear exchange, allow human intervention, and perform damage assessment. The model performs the fire planning needed in a nuclear engagement, considers civilian collateral damage constraints, simulates the nuclear exchange and then determines prompt and delayed casualties and material damage to a target bank and to a civilian population data base resulting from the timed sequence nuclear strikes.

GENERAL DESCRIPTION: NUFAM is a two-sided, mixed model involving land forces only. It is primarily designed to consider groupings ranging in size from a battery or battalion up to theater-level forces. The lower limit of this range, however, may be manipulated to consider units anaywhere between a platoon and a brigade, while the upper limit may be adjusted to consider groupings ranging from a division to a theater. Simulated time is treated on an event store basis, using the GASP IV language. The nuclear exchange is simulated by automating, based on input criteria, the selection of nuclear targets and the allocation of firing assets against these targets while minimizing civilian damage. The human intervention is accomplished by placing a man in the loop with the ongoing simulation. A Cathode ray tube is the input/output medium and allows the user to retrieve information and subsequently influence decisions made by the simulation. The damage assessment is accomplished through circle/rectangle overlap calculations.

INPUT:

- o 31 types of input data are required to define commanders firing guidance (2), fire planning (2), weapon characteristics (4), graphic info (4), assessment parameters (6), GASP IV (4), preplanned info (1), civilian collateral damage criteria (8)
- o SEPARATE INPUTS INCLUDE:
  Target Info
  Firing Units
  Yield
  Battlefield Unit Info

OUTPUT:

- o Timed sequenced list of all events, flee-fire
- o Fire event results
- o End of Period status of all units
- o Civilian population data base
- o Histograms and CALCOMP plots (optional)
- o Hard copy of graphic displays (optional)

MODEL LIMITATIONS:

- o No cumulative radiation from multiple burst, or distribution of delayed casualties in time.
- o No offsetting of DGZ to avoid civilian damage

HARDWARE:

- o Computer: UNIVAC 1108
- o 1557/58 Graphic display subsystem (optional)
- o Operating System: EXEC VIII
- o Minimum Storage Required: .61K
- o Peripheral Equipment: One tape drive, FASTRAND Format mass storage

SOFTWARE:

- o Programming Language: FORTRAN and ASSEMBLER
- o Library Routines: UNIGRASP (optional) and GASP IV

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 man-days to structure data in model input format
- o 30 minutes CPU time for 6000 targets and 500 fires
- o 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 major studies early 1977 lasting 7 months

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: MAJ R. L. Howe
US Army Concepts Analysis Agency, MRM
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1639

MISCELLANEOUS:

- o NUFAM shares a common data base with Target Acquisition Routine (TAR)
- o NUFAM encompasses NAR III B
- o NUFAM may be run with or without the human intervention. In the latter case, the UNIGRASP system and the 1557/58 graphic subsystem will not be needed.

KEYWORD LISTING: Analytic Model; Computerized; Limited War; Nuclear Exchange; Two-Sided; Land Forces

TITLE: NUREX - Nuclear Requirements Extrapolator

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: NUREX is a computerized model that, as a part of the Nuclear Requirements Methodology (NUREM), is designed to extrapolate, from Combat Sample Results, the nuclear weapons expenditures and resulting losses associated with a specific scenario.

GENERAL DESCRIPTION: NUREX is a two-sided, deterministic model oriented primarily to a Theater Land Battle force. It is designed to consider units ranging in size from Blue Brigades to Red Divisions up to the theater level. Simulated time is treated on a time step basis. The model is an interactive simulation based on a model hierarchy assessment of losses and expenditures.

INPUT: From the Theater Nuclear Scenario-opposing force (by various nationality and Warsaw Pact types played) strengths, Blue and Red replacement policies, Red Division Replacement Criteria, Blue and Red personnel/equipment daily replacements, nuclear delivery systems to be played (by type, total number and associated delivery yields), delayed casualty decay factors, and Combat Sample Results, nuclear warheads expended and factors representing personnel and equipment losses and units broken.

OUTPUT: NUREX produces both hard copy tabulations and magnetic tape records in the form of a Historical Audit Trail of a Theater Level Conventional/Nuclear War.

MODEL LIMITATIONS:

- The length of time simulated is based on 24-hour iterations.
- Nuclear delivery systems cannot exceed six for Red and Blue, with five varying yields per system.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 32K
- Peripheral Equipment: 1558 Display Console, 1557 Display Controller, printer

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: Tactical Nuclear Weapons Requirements Methodology (TANREM) Phase II: Methodology Development Vol. IV, Appendix G: Nuclear Requirements Extrapolator (NUREX) Model CAA-SR-7421.
- The above represents user's documentation and technical documentation.

TIME REQUIREMENTS:

- o 3 months to acquire base data
- o 3 man-days to structure data in model input format
- o 1 CPU second per 24-hour day of simulated conflict
- o 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 20 times per year

USERS: Player Group, War Gaming Directorate, US Army Concepts Analysis Agency

POINT OF CONTACT: MAJ R. L. Howe
US Army Concepts Analysis Agency, MRM
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1639

MISCELLANEOUS: NUREX is a spinoff of ATWAR and is envisioned as being the basis of a family of special-purpose models each using the hierarchical approach but differing in detail and emphasis to meet specific requirements.

KEYWORD LISTING: Man-Machine Integration; Two-Sided Computerized; Extrapolator; Theater Nuclear Requirements; Deterministic; Historical Audit Trail

TITLE: OASIS - Operational Analysis Strategic Interactions Simulation

PROPONENT: Headquarters, Strategic Air Command (SAC)

DEVELOPER: Science Applications, Incorporated (SAI)

PURPOSE: A computerized, analytical model designed to simulate the interaction of reentry vehicles (RV), anti-ballistic missiles (ABM), and intercontinental ballistic missiles (ICBM). Endoatmospheric simulations are limited to wing size engagements; exoatmospheric events are simulated continentwide. The model primarily analyzes a small scale strategic engagement in a nuclear environment. It considers nuclear effects such as blast, thermal, radiation, dust and debris (fallout) and rainout (including ice crystals).

GENERAL DESCRIPTION: A one-sided model involving the simulation of strategic missile operation and weapon interaction in a nuclear environment. Both persistent and nonpersistent nuclear effects are tested. The model has both deterministic and stochastic features, using physics, probability, and numerical analysis as solution techniques.

INPUT:

- o Descriptive system characteristics for both attacking RVs and defending ABM and ICBMs (including geographic location).
- o Nuclear vulnerability threshold levels for each nuclear effect considered. Attack and launch doctrine and timing.

OUTPUT: A history tape of all game events and a printed output containing detailed game interactions for each time step where significant events occur. The CCTC/SAGA version outputs a summary table of the results of the scenario.

MODEL LIMITATIONS:

- o Capability of simulating only persistent effects as shock fronts, thermal pulse, and nuclear dust clouds in a local target complex (missile wing).
- o The number of RVs/ABMs/ICBMs within this local complex is limited to 100 each in the SAI and SAC versions, and 300 RVs, 150 ICBMs, and 100 ABMs in the CCTC/SAGA version.

HARDWARE:

- o Computer: IBM 360/65, UNIVAC 1108, or GE 635, HIS 6080
- o Operating System: OS/MVT (IBM), GCOS (HIS)
- o Minimum Storage Required: 350K, IBM 360; 72K, HIS 6080
- o Peripheral Equipment: disk pack, tape drive, printer, card reader

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Six volumes

TIME REQUIREMENTS:

- o Average of 6 weeks to accumulate input data
- o 1 man-month to structure data in model input format
- o 50-60 minutes CPU time, dependent on the amount of defense in the scenario, and on the amount of nuclear cloud detail desired by the user
- o Average of 1 week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS: Headquarters SAC/JSTPS, OJCS/SAGA, DNA, AFSC/FTD, CCTC, AFWL, LASL

POINT OF CONTACT: Headquarters, Strategic Air Command
XOXM
Offutt AFB, Nebraska 68113
Telephone: Autovon 271-2332

MISCELLANEOUS: OASIS-74 supersedes other versions of OASIS. In OASIS-74, the nuclear cloud geometries and loading are described by VORDUM (dust) and WAIVOR (water and ice) routines. The erosion of specific heatshield materials is determined using the Erosion/Ablation Systems Analysis Program (EASAP), which handles both atmospheric and cloud entrainment erosion.

KEYWORD LISTING: Analytical Model; General War; Computerized; Nuclear Exchange; Nuclear Effects; Fratricide; Damage Assessment/ Weapons Effectiveness; Deterministic; Event Store

TITLE: PFM - Patient Flow Model

PROPONENT: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences, US Army

DEVELOPER: Office of The Surgeon General, Department of the Army

PURPOSE: The Patient Flow Model is a computerized, logistics flow analysis tool. The flow of patients through as many as four echelons can be simulated, while varying strengths, admission rates, skip echelon policies, fast or slow evacuation means and dispersion factors are evaluated. Forecasts of hospital bed requirements and patient evacuation requirements by echelon, plus impact upon the CONUS hospitalization system from admissions evacuated from the theater are also evaluated. The model can be used to evaluate effects of changes in evaluation policy, changes or use of skip policy, and sensitivity of any assumptions concerning input variables.

GENERAL DESCRIPTION: The model is a one-sided, deterministic, time-step patient flow analyzer for theater-level land forces. The smallest group is usually a division, but brigades, task forces, and other unique combat elements can be separately analyzed. Primary solution techniques involve probability distributions of patient accumulation and dispositions.

INPUT:

- o Dispersion factors
- o Number of time periods
- o Length of periods
- o Number of echelons
- o Number of regions per echelon
- o Troop strengths by region by time period
- o Wounded, disease and nonbattle injury rates by region by time period
- o Evacuation and skip policy

OUTPUT:

- o Admission summary by echelon
- o Patient flows and status at each time period in each echelon (bed requirements, evacuees, deaths, discharges, skipped evacuees)

MODEL LIMITATIONS:

- o Maximum of 24 time periods
- o Total days not to exceed 360
- o Four echelons; eight regions each
- o Two-day minimum time period

HARDWARE:

- o Type of Computer: CDC 6500
- o Operating System: SCOPE 3.4.4
- o Minimum Storage Required: 70 Octal K
- o Peripheral Equipment: Reader, printer, 2 disk files

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Complete in one manual with narratives, flowchart, program listing, and input formats. Data base probability distributions are also included. User's documentation is complete, but technical documentation is limited.

TIME REQUIREMENTS:

- o Five man-months to acquire base data.*
- o One man-month to structure data in model input format.*

*Given the present data base (probability distribution) it takes only 5 to 30 minutes to structure an input deck.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS:

- o Principal: Assistant Superintendent, Combat Developments and Health Care Studies, US Army

- o Other: US Army Command and General Staff College
  Office of The Surgeon General, Department of the Army

POINT OF CONTACT: Assistant Superintendent
Combat Developments and Health Care Studies (HSA-CSD)
Academy of Health Sciences, US Army
Ft. Sam Houston, Texas 78234
Telephone: Autovon 471-3303

MISCELLANEOUS: The "T52" module of the OJCS JOPS III System is an interactive version of this model. AHS will acquire and attempt to place this system on the CDC 6500. The "T52" adds several enhancements to include blood/fluid utilization, air/surface evacuation requirements, and other planning information.

KEYWORD LISTING: Analytical; Patient Flow; Logistics; Land Forces; Division Level; Deterministic

TITLE: POSTURE System

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: POSTURE is a computerized, analytical logistics model designed to assist in defining the strategic mobility resources required for contingency situations and to assist in assessing the delivery capability of a given set of resources. The primary problem addressed is that of determining the optimal least-cost strategic mobility resource system required to meet time-phased strategic deployment requirements or, conversely, the maximum deployment capability of the given mobility resources. The model is concerned with both commercial and military mobility resources, DOD transportation requirements to meet concurrent non-war and peacetime obligations, time-phased readiness of movement requirements and availability of lift resources, intermediate transfer points, mixed commodity loads, peacetime economic value of military resources, mobility support constraints, and multiple contingencies.

GENERAL DESCRIPTION: The POSTURE System is actually three computer programs or phases. These are the matrix generation, the LP and the Report Writer. All are run on HIS 6080. POSTURE involves land, air and sea forces. It is designed to consider troops, vehicle groups, and cargo categories at the infantry level. The model is deterministic. Simulated time is treated on a time step basis. Linear programming is the primary solution technique employed.

INPUT:

- Origin/destination sets for force transfers
- List resources
- Cost parameters for the resources
- Time-phased requirements by contingency and unit type
- Vehicle characteristics, speed, payload
- Allowable routes and route distances
- Operational delay assumptions
- Attrition factors (if used)
- Convoy limits by theater and time period
- Resource availability
- Cargo characteristics: containerized or outsize

OUTPUT:

- Computer printout of optimal solution, giving ten-year system cost, fleet sizes, level of deployment activities, and basing and readiness levels of resources. Report writer tables are also available aggregating, manipulating, and interpreting solution results.

MODEL LIMITATIONS:

- 5 theaters
- 5 world areas
- 20 time periods (variable length)
- 12 commodity types
- 9 origins
- Vehicles are fractionalized
- All events are deterministic
- Cargo requirement integrity is not maintained

HARDWARE:

- o Computer: HIS 6080
- o Operating System: HIS: 6080 GCOS
- o Minimum Storage Required: 70K words
- o Peripheral Equipment: Tapes and Disk

SOFTWARE:

- o Programming Languages: FORTRAN IV and LP6000
- o Documentation: (1) OAD-CR-5: "POSTURE System Description and User's Manual" June 1973
  (2) OAD-CR-52: "Prepackage - A Model of the POSTURE Linear Programming System" August 1974
  (3) OAD-CR-67: "POSTURE-to-Simulator (POSSIM) - A Module of the POSTURE Linear Programming System" October 1974
  (4) "Matrix Generator (MATGEN) Module of the POSTURE Linear Programming System" (Draft) February 1977

TIME REQUIREMENTS:

- o 2 weeks to acquire base data
- o 1 week to 2 man-months to structure data in model input format
- o 40 minutes to 1 hour CPU time per model cycle
- o 4 hours to 2 man-days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per year

USERS: Organization of the Joint Chiefs of Staff (J-4)
Office of the Assistant Secretary of Defense (SA)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon
Washington, D. C. 20301
Telephone: OX7-3686

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Deterministic; Time Step

TITLE: PLOM - Prescribed Load Optimization Model

PROPONENT: U.S. Army Logistics Center

DEVELOPER: General Research Corporation

PURPOSE: PLOM is a computerized, analytical, optimization model designed for the development of "optimal" prescribed loads. The model is primarily concerned with the development of a repair parts list - both the types of parts and the quantity of each - that ought to be included in the prescribed load of a military unit to best satisfy a unit's requirements without sacrificing its mobility. Corollary to this concern is that of reducing the number of different items stocked and of reducing inventory investment.

GENERAL DESCRIPTION: PLOM involves land, air and sea forces. It is primarily designed to consider units of battalion or independent company size, but it may be manipulated to consider any organization having a constrained ability to hold inventory and using a "use one/order one" replenishment policy. The model is stochastic. Marginal utility, probability, and search theory are the primary solution techniques used.

INPUT:

- o Tape file containing a list of eligible items and their demand rates
- o Units of issue, unit prices, unit weights, unit cubes and military essentiality (optional)
- o A punched card containing the constraint and miscellaneous control information

OUTPUT:

- o A list of the prescribed load in terms of the items and quantities that make up the prescribed load, the total dollar value, weight, and cube, and the expected number of unsatisfied requirements.
- o Additional options are detailed listings of items and quantities in order of priority for stockage, listing of final prescribed load, summary characteristics of prescribed load, summary characteristics of list of items eligible for stockage (produced by Automated Input Data System), numerous special reports available from Data Postprocessor.

MODEL LIMITATIONS: The model is applicable only if a "use one/order one" resupply policy is followed.

HARDWARE:

- o Computer: CDC 6400 or 6500 and IBM 7094
- o Operating System: SCOPE on CDC 6400 and 6500
IBSYS on IBM 7094
- o Minimum Storage Required: 32K words (IBM 7094)
151K words (CDC 6500)
(Word counts are decimal)
- o Peripheral Equipment: 4 tape (or disk) files

SOFTWARE:

- o Programming Language(s): FORTRAN
- o Documentation: H. A. Markham et al, "A Model for Optimizing Prescribed Loads," RAC-TP-424, June 1971 (AD 886313L)
- o Both user's documentation and technical documentation are complete. Conversion documentation for operation on the IBM 7094 has been provided the sponsor.

TIME REQUIREMENTS:

- o Time to acquire and structure the base data varies widely depending on the problem.
- o CPU time per model cycle averages about 2 minutes on CDC 6400; not known for the IBM 7094 due to the fact that the model has not been given a full run as yet on this machine.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required. (NOTE: This model has never been employed since its acquisition by the Army.)

USERS:

- o Principal: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate (ATC-OSA)
Fort Lee, Virginia 23801
Telephone: Autovon 687-4180/3403

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Stochastic

TITLE: PROFORMA - Pre-Voyage Performance Analysis

PROPONENT: Military Sealift Command

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: PROFORMA is a computerized model that provides Headquarters, Military Sealift Command with comparative ship voyage, income, and expense data to assist management decision making in the acquisition and economical utilization of shipping. The model addresses the problem of how to economically transport cargo by sea.

GENERAL DESCRIPTION: PROFORMA is a one-sided model and is based on a deterministic algorithm. The model determines the cost incurred, revenue gained and length of time involved in the movement of cargo by a specified ship. The model's results give costs and revenue of potential voyages from which decisions can be made concerning future ship voyages and expected shipping requirements for the future. The model considers events in a time step fashion and uses heuristic logic.

INPUT: The model contains a data base with the following information:

- o Characteristics of all MSC controlled dry cargo ships
- o Cargo handling capability of all worldwide water ports
- o Distance between ports
- o Billing rates for transporting cargo to various ports from a given port

Therefore, a user need only to select a ship, ports of call, and the cargo to be moved for a simulation.

OUTPUT:

- o Income by cargo type
- o Ship costs incurred
- o Ship schedule (arrivals, departures, cargo by type lifted and unloaded)
- o Optimal ship usage after a planned voyage has been terminated

MODEL LIMITATIONS:

- o 2 year period
- o 40 ports
- 9 30 commodities

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE 3.3 or 3.4
- o Minimum Storage Required: 54K octal 64 bit words
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: (1) NSWC/DL Technical Report TR-3568, The PROFORMA Model (MOD 2), (Command-Users Manual)

TIME REQUIREMENTS:

- A few minutes to structure input
- 90 seconds CPU time per model cycle
- A few minutes to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: Military Sealift Command

POINTS OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 663-7406 or 663-8645

Commander, Military Sealift Command
Ship Operations Branch (M-321)
Washington, D. C. 20390
Telephone: Autovon 292-2911
Commercial 202/282-2911

MISCELLANEOUS:

- The current version of PROFORMA supersedes the original version of PROFORMA
- Modifications have been made to increase flexibility and efficiency

KEYWORD LISTING: Analytical Model; Logistics; Costing; Scheduling; Sea Transportation

TITLE: PWM - Patient Workload Model

PROPONENT: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences, USA

DEVELOPER: US Army Logistics Center

PURPOSE: PWM is a computerized, analytic, logistics model designed to assess the resource requirements for health care delivery to the Army-In-The-Field. It determines the number and types of patients expected from specific combat situations and resources required to process this workload through a Division medical support system.

GENERAL DESCRIPTION: The Patient Workload Model is a one-sided, stochastic model dealing with land forces only. It was designed to generate realistic patient loads impacting on the combat zone medical systems by accessing the MEDPLN automated data base; to process combat division patients from the battalion aid station to the supporting combat hospitals, providing reports on this processing useful to medical planners; and to produce a patient stream suitable for further processing by the Hospital Model. The model is divided into two submodels, the Patient General Submodel which accomplishes the patient generation function, and the Division Processor Submodel which accomplishes the patient processing function through a divisional level medical support system.

INPUT:

- o Scenario-unit, area, type operations, terrain, climate, troop strength, length of engagement
- o Medical system structure
- o Medical doctrine

OUTPUT:

- o Number of admissions by class
- o Number of outpatients by class
- o Statistics on patient flow, treater utilization, ambulance utilization

MODEL LIMITATIONS:

- o Does not play nuclear warfare
- o Applies to Army-in-the-field personnel only

HARDWARE:

- o Computer: CDC 6500
- o Operating System: SCOPE 3.4.4
- o Minimum Storage Required: 140K octal

SOFTWARE:

- o Programming Languages: FORTRAN IV and SIMSCRIPT
- o Documentation: Complete in one manual

TIME REQUIREMENTS:

- o 2 man days to structure data base
- o 15 to 30 minutes CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly

USERS: Assistant Superintendent, Combat Developments and Health Care Studies

POINT OF CONTACT: Assistant Superintendent
Combat Developments and Health Care Studies
Academy of Health Sciences (HSA-CSD)
Ft. Sam Houston, Texas 78234
Telephone: Autovon 471-3303

KEYWORD LISTING: Analytic; Medical; Computerized; Land Forces; One-Sided; Stochastic; Event Store

TITLE: QUICK - Quick-Reacting General War Gaming System

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Command and Control Technical Center; Defense Communications Agency (CCTC/DCA) and the Lambda Corporation - Systems Sciences, Inc.

PURPOSE: QUICK is a computerized, analytical model designed to generate strategic plans for a worldwide nuclear exchange and to simulate the planned events. The primary problems addressed are those of determining the optimal allocation of nuclear weapons and delivery vehicles and the simulation of the resulting plan by means of random numbers. QUICK is designed primarily to assist the war gaming analyst at the Joint Staff level with the generation of detailed strategic nuclear war plans satisfying general objectives using available forces. Evaluation of the plans is available using expected-value techniques. The simulation may also be used to verify or improve upon the expected-value estimates of the plans generated. In addition, the model may be used to study alternate strategies, retargeting-reprogramming, ballistic missile defense effectiveness, command and control degradation, air defense and MIRVs.

GENERAL DESCRIPTION: QUICK is a two-sided model addressing strategic employment of missile, bomber, and naval forces. It is primarily designed to consider groups ranging in size from a squadron or air wing (for air forces) or a naval task force (for sea forces) up to the entire array of national strike forces. The lower limit of this range may be manipulated to allow consideration of individual bombers, missiles, or ships. The upper limit may be adjusted to consider wings or fleets. The model uses a mixture of deterministic and stochastic techniques. The primary solution techniques used are generalized LaGrange multipliers, heuristic techniques and probability considerations. Simulated time is treated on an event store basis.

INPUT:

- Target lists with attributes. (The location and characteristics of the weapons and targets must be specified in considerable detail. The data may be drawn from a variety of classified and unclassified sources with computer-assisted methods.)
- Geographic data pertaining to air defense zones and bomber routing.
- Capabilities and characteristics of weapons sytems.
- Planning parameters (probabilities, reaction times, etc.)

OUTPUT:

- Computer printouts of weapon allocation, detailed bomber and missile plans, expected damage, attrition, history of events and summaries.
- Both detailed and summary output is available by various sorts of selective retrievals.
- Intermediate, initial or final outputs are also available.

MODEL LIMITATIONS:

- Maximum number of data base entry items (excluding attributes) is 12,000.
- 5,000 targets per side.
- 200 weapon groups per side.
- 1,000 weapons per group.
- Does not include individual encounters between weapons systems and interceptors.

HARDWARE:

- Computer: H6080, GECOS
- Minimum Storage Required: 60K words.

SOFTWARE:

- Programming Languages: FORTRAN, GMAP, IDS/COBOL
- Documentation:
  (1) "General Description for the NMCSSC Quick-Reacting General War System (QUICK)."
  (2) Analytical Manual - 4 Volumes.
  (3) Programming Specifications Manual - 4 Volumes.
  (4) User's Manual.
  (5) Operator's Manual.

TIME REQUIREMENTS:

- Data base is continuously being acquired.
- 2 months to structure data in model input format.
- Average of 10 hours CPU time per model cycle.
- 4-6 months learning time for users.
- Average of 15 hours to analyze and evaluate results.

SECURITY CLASSIFICATION: Model and documentation are UNCLASSIFIED. Output is determined by USER.

FREQUENCY OF USE: On demand.

USERS:

- Principal: OJCS, SAGA, Strategic Forces Division

POINT OF CONTACT: Command and Control Technical Center (C-314)
The Pentagon
Washington, D. C. 20301
Telephone: OX-53521

MISCELLANEOUS:

- QUICK generated output may be used as input to the Nuclear Exchange Model (NEMO), the Event Sequenced Program (ESP), and SIDAC models.

KEYWORD LISTING: Analytical Model; General War; Air Forces; Sea Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Event Store

TITLE: RADOBS SYSTEM - Radar Observations System

PROPONENT: Headquarters, NORAD, Aerospace Defense Command, ADCOM/XPYS

DEVELOPER: RCA-NORAD/ADCOM

PURPOSE: The RADOBS System is a computerized analysis model comprising several programs which will generate a series of vacuum-ballistic (rotating earth) trajectories for a given set of launch and impact points and radar look angles for each generated trajectory. Subsequent programs are designed to process the generated data. Missile trajectories may be generated (via table lookup) to match intelligence estimates of apogee altitude versus range. The model is designed for the analysis of the coverage capabilities of single or multiple radar systems and to analyze the timeliness of generated look angles.

GENERAL DESCRIPTION: The RADOBS programs are two-sided models which have deterministic elements. Both land and sea-launched ballistic missiles may be used. It is capable of considering individual radar-trajectory pairs and, if desired, can aggregate up to a maximum of 98 radar sensors, 600 launch point coordinates, and 300 impact point coordinates. The two-sided nature of the programs allows the user to determine radar sensor coverage of either launch or impact areas, plus associated radar detection-to-impact times. Simulated time is treated on an event store basis. Network analysis and queuing theory are the primary solution techniques used.

INPUT:

- RADOBS Driver:
  - (1) Run mode card
  - (2) Sensor parameters and location
  - (3) Launch point coordinates and launch angles
  - (4) Impact point coordinates
  - (5) Table lookup (X-Y pairs of launch angle versus ground range)
- Data Processing Programs:
  - (1) Special processing card
  - (2) Time frequency
  - (3) Radar sub-systems

OUTPUT:

- Computer printout of trajectory and radar look angles
- Magnetic tape containing trajectory parameters and radar detection-to-impact times
- Computer printout summarizing coverage data by launch point, by impact point, and by detection-to-impact times

MODEL LIMITATIONS:

- Keplerian orbits - no perturbations
- Vacuum trajectories
- No powered flight
- No atmospheric reentry
- Fan-shaped sensors (two fans)
- 98 sensors, 600 launch points, 300 impact points

HARDWARE:

- o Computer: Honeywell 6060
- o Operating System: GCOS
- o Minimum Storage Required: 8 to 60K per program
- o Peripheral Equipment: 2 random access temporary files; up to 3 magnetic tape drives

SOFTWARE:

- o Programming Languages: FORTRAN IV and SIMSCRIPT II.5
- o Documentation: (1) R. J. Winkelman, "The Philosophy, Mathematical Methods, and Computational Methods for the MEWSAC System and the MEWSAC Program," Radio Corporation of America, Moorestown, N. J., Dec 1961
  (2) User's documentation for RADOBS, SUMMARY, and SUMMTRSP is in preparation.

TIME REQUIREMENTS:

- o 1 day to 1 week to acquire data base, dependent on input
- o 1 day to 1 week to structure data
- o CPU time processed at 470 launch-impact-radar combination per minute
- o Subsequent processing varies from 1-2 minutes per radar system
- o 1 day-3 months to analyze and evaluate results

SECURITY CLASSIFICATION:

- o Model is UNCLASSIFIED
- O The data base may be SECRET.

FREQUENCY OF USE: 100 times per year

USER: NORAD/XPY

POINT OF CONTACT: Headquarters, NORAD (XPYS)
Peterson AFB, Colorado 80914
Telephone: Autovon 692-3535/3161
Commercial 303/635-8911, Ext 3535/3161

MISCELLANEOUS: The program utilized several programs including the RADOBS driver (a version of the MEWSAC program), SUMMARY and SUMMTRSP. Several other programs not currently in normal use (e.g., for CONUS plots of iso warning times) are available for use within the system. Several updates of the model have been made since the original MEWSAC program was developed. These changes include a magnetic tape output capability, a table lookup feature, capability to process depressed/lofted trajectories, plus changes to improve the efficiency of the program. Follow-on data processing programs may be added as required.

KEYWORD LISTING: Analytical Model; General War; Limited War; Damage Assessment; Land Forces; Sea Forces; ICBM; SLBM; MRBM; IRBM; Radar; Radar Systems; Warning; Detection-to-Impact; Computerized; Two-Sided; Deterministic; Event Store; Keplerian; Ballistic

TITLE: RAM - Red Artillery Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The purpose of this model is analysis.

GENERAL DESCRIPTION: The Red Artillery Model is a computerized, deterministic model. It accepts an acquired target list from the Target Acquisition Model and assigns artillery batteries to targets in accordance with Red doctrine. Simulated time is treated on an event store basis. The solution technique used is that of a computer simulation algorithm.

INPUT:

- Acquired target list which includes target location, type, size and environment
- Location of Red artillery batteries

OUTPUT:

- Computer printout of a list of time sequenced fire mission against Blue targets
- A summary of rounds fired by round type casualties achieved by Red artillery and armor losses to artillery fire

MODEL LIMITATIONS: Limited to ten types of artillery, two environments, and 15 types of targets

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 33K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Red Artillery Model, December 1974, USACAA. Available in the Defense Documentation Center. This publication is a complete user's and technical documentation.

TIME REQUIREMENTS:

- Approximately 1 man-month to acquire basic data
- 0.25 man-months to structure data in model input format
- 2 minutes CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: The Red Artillery Model provides support to the Theater Rates Model.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Artillery; Deterministic

TITLE: RAPIDSIM - Rapid Intertheater Deployment Simulator

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: The Rapid Intertheater Development Simulator is a computerized, analytical logistics model designed to simulate the rapid deployment of combat units and their resupply required for a military contingency operation. The model is used to determine the minimum time required to deliver each portion of the unit to its destination using ships and/or aircraft. All units are assumed to have a priority for movement. All movement of units are scheduled according to priority.

GENERAL DESCRIPTION: The RAPIDSIM is a deterministic model involving both aircraft and ships. Cargo tonnage is made available at ports of embarkation (POEs) according to schedules that reflect the readiness for movement of the units, the order of priority of units to be moved, and the movement times to the POEs from origin points. Specified airlift and sealift resources are initially applied to the movement of the cargo on the basis of a schedule of the availability of the resources at the POEs. The unit delivery rate is determined primarily by vehicle speed, vehicle capacity, and the time for loading and offloading.

INPUT:

- o Available number of aircraft by class
- o Available number of ships by class
- o POEs
- o PODs
- o Convoy Routes
- o Transportation modes
- o Time periods for initial ship availability
- o Commodities and units
- o Attrition rate of vehicles

OUTPUT: In addition to a detailed log of movements, summary reports are available as follows:

- o Summary of Materiel Movements -- showing for each POD the amount of each commodity required, moved, closed, the amount of the requirement which was not satisfied, and the amount lost
- o Summary of Aircraft Idleness -- showing the number of utilization hours remaining unused during each day
- o Summary of Unused Ship Resources at POE -- showing the ship periods of availability at each POE by time period and ship type
- o Summary of Unused Ship Resources at POD -- showing the ship periods of availability at each POD by time period and ship type
- o Summary of Aircraft Sorties from POEs -- showing the number of aircraft sorties to each POE by 5-day time period
- o Summary of Aircraft Sorties from PODs -- showing the number of aircraft sorties to each POD by 5-day time period
- o Summary of Ship Attrition -- showing each ship the number made available, the number entering deployment, the number surviving, the number lost, and the percentage of deployed ships lost
- o Summary of Ships Arriving at POD -- showing for each POD the scaled number of ships arriving by ship and time period along with an implication of which ships were convoyed

- o Summary of Convoy Utilization -- showing for each convoy route the number of convoyed ships departing during each period; also shown are the numbers arriving in convoy and the convoy size limit for each period
- o Summary of Ships Departing from POE -- showing the number of ships by each type sailing from each POE by 5-day time period
- o Summary of Non-Convoy Ships Sailing to Each POD -- showing the number of ships leaving each POE and sailing to each POD by time period

MODEL LIMITATIONS:

Parameter	PARAMETER RANGES Maximum No.	Minimum No.
Time Periods	*	1
Aircraft Classes	*	1
Ship Classes	*	1
POEs	*	1
PODs	*	1
Convoy Routes	10	0
Mode Definitions	3	1
Time Periods for Initial Ship Availability	30	1
Commodities	40	1
Attrition Rate Changes at Each POD	6	0
Movement Requirements	Unlimited	1
Partially Used Vehicles (at each point in the run)	400	0

*Limited by computer size

HARDWARE:

- o Computer: Honeywell 6080 or Honeywell 6180 for MULTICS
- o Operating System: GCOS
- o Minimum Storage Required: 36K plus scenario core requirements
- o Peripheral Equipment: Magnetic tapes and disk

SOFTWARE:

- o Programming Languages: FORTRAN Y and PL1
- o Documentation: User's Manual by General Research Corporation, 1 June 1974. Update in progress. Technical documentation is not available.

TIME REQUIREMENTS:

- o 2 weeks to acquire data base
- o 1 week to 2 man-months to structure data in model input format
- o 1 minute CPU time per model cycle
- o 4 hours to 2 man-days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 260 times per year

USER: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate
Technical Advisor Office
Pentagon, Washington, D. C. 20301
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KEYWORD LISTING: Analytical Model; Logistics; Transportation Airlift; Sealift; Closure Dates; Computerized; Deterministic

AD-A050 320 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON D C F/G 15/7

CATALOG OF WAR GAMING AND MILITARY SIMULATION MODELS (7TH EDITI--ETC(U)

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TITLE: REACT - Requirements Evaluated Against Cargo Transportation

PROPONENT: Commander, Military Sealift Command

DEVELOPER: Naval Command Systems Support Activity

PURPOSE: REACT is a computerized, analytic, logistics model which simulates the movement of cargo and passengers by air or sea between up to 9 theater and 40 individual ports by merchant ships and tankers. REACT determines the capability of current or projected Sealift and Airlift forces to deliver required cargo in a contingency or general war situation.

GENERAL DESCRIPTION: REACT is a two-sided, deterministic model involving both air and sea forces. It considers individual ship and measurement ton of cargo, with a range of possible manipulation of up to 750 ships, 998 cargo generations, and 40 ports. Simulated time is treated on a combination of time step and event store basis. The primary solution techniques used are linear programming techniques, network analysis, and probability techniques.

INPUT:

- o Cargo movement requirements
- o Projected number of ships, theaters, and ports of interest
- o Distance table
- o Productivity figures for loading and unloading ships
- o Convoy size and speed
- o Projected attrition rates

OUTPUT:

- o Computer printout showing daily event listing and system status summary at selected time intervals
- o Data may be displayed in any desired format utilizing an attached report writer capability

MODEL LIMITATIONS:

- o 750 ships or 1,000 aircraft
- o 998 cargo generations
- o 40 ports
- o 9 theaters
- o 9 cargo types
- o 50 ship types

HARDWARE:

- o Computer: UNIVAC 1108/1110
- o Operating System: EXEC VIII
- o Minimum Storage Required: 30K
- o Peripheral Equipment: Printer, Card Reader, Tape Drive

SOFTWARE:

- Programming Language: FORTRAN V ANSI COBOL
- Documentation: User's Manual - NAVCOSSACT DOC NO 53E302C, 4M-1
  Program Maintenance Manual - NAVCOSSACT DOC NO. 53E302C, MM-01, VOL I and II
- Both user's documentation and technical documentation are complete.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 1 man-month to structure data in model input format
- 1 to 60 minutes CPU time per model cycle
- Substantial learning time for players
- Matter of days for each run to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2 times per year

USERS:

- Principal: Chief of Naval Operations OP-96
- Other: OP-405, Commander, Military Sealift Command

POINT OF CONTACT: Director
Integrated Sealift Systems, M-62B, CDR Horne
Building 210
Washington Navy Yard
Washington, D. C. 20374
Telephone: Autovon 288-3633
Commercial 202/433-3633

KEYWORD LISTING: Computerized; Analytic; Logistics; Two-Sided; Deterministic; Air Forces; Sea Forces; Combination Time Step and Event Store

TITLE: REACT Model

PROPONENT: Federal Preparedness Agency, General Services Administration (FPA/GSA)

DEVELOPER: Mathematics and Computation Laboratory, FPA/GSA

PURPOSE: REACT is a computerized, on-line trans-attack damage prediction model, designed to provide quick estimates of losses or residual values for a select group of priority resources while a nuclear attack is in progress and thus provide the basis for policy decisions. The REACT Model predicts the extent of damage or casualty losses on selected resources by measuring the impact of nuclear detonations on the basis of parameters used in matching the weapon characteristics against those of the targets or resources in question--along with a consideration of environmental factors. The specifications for the parameters, the structure of the damage and casualty assessment procedures, and the output information afforded parallel those basic elements in the READY model. They are described in the discussion of that model. The REACT system is characterized by speed and flexibility and is user-oriented in that the computer, which constitutes the center of operations, can be queried in English language statements for the output, or have input data entered, by the user(s) from remote terminals. Answers will normally be provided in a matter of seconds, but may require minutes for extensive printouts. This model is intended for use in providing individualized up-to-the-minute status reports. Therefore, it is designed primarily for use in an interactive mode.

GENERAL DESCRIPTION: REACT is a one-sided, deterministic model capable of considering individual resource locations if desired, and capable of aggregating up to a maximum of 17,000 resource locations within CONUS. Probability theory is the primary solution technique used. Simulated time is treated on an event store basis. Damage predictions are computed against the data base as each weapon is inputted.

INPUT: Basic input parameters can be classed as weapons and resources. The point of detonation for each weapon is the actual ground zero (AGZ) or the best approximation to it. Weapon characteristics consist of the yield of warhead, the height of burst, and time of detonation. Resource locations are provided in the same coordinate system used for the weapon locations. The resource data also include vulnerability characterizations of structural type of identification capable of being interpreted into the vulnerability characterization. Provision is also made to carry the identifying information, the classification code by which the category is structured, and up to ten data fields of category value. Population data are carried for the major SMSAs and for each county above 50,000 in population count.

OUTPUT: Outputs are available primarily as visual displays on CRT terminals or as printouts from teletype compatible terminals. Certain selected displays can be coupled into closed circuit TV. On special request, printer listings of REACT weapons or resource files can be obtained. Estimates of damage, casualty and availability status are given either for points or in summary form for resource categories. Weapons summaries are also available.

Thus, the analyst may ask a wide range of questions interactively with the model in order to obtain an estimate of the most recent status of the attack pattern and its effects on selected critical resources. The precision of the model analysis is the same as READY because the line of analysis is the same. But, since the entire data base contains only about 17,000 points, in order to insure expeditious real-time response, much of the detailed coverage afforded by the application of READY to the data base carried in the emergency package has been sacrificed.

MODEL LIMITATIONS: REACT uses the same weapon effects parameters used by READY in matching the weapon and resource data to make the damage and casualty assessment estimates. Their reliability is subject to the same limitations described for READY results. REACT casualty estimates are based on direct effects only; there is no consideration of radioactive fallout.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 65K
- Peripheral Equipment: Interactive teletype compatible terminals connected on-line, remote and local

SOFTWARE:

- Programming Language: VULCAN
- Documentation: (1) "REACT Trans-Attack Information Systems," REG-103, National Resource Analysis Center, Resource Evaluation Division, OEP, September 1969
  (2) REACT User's Guide GSA/OP/MCL TM-25, 1 Feb 1975

TIME REQUIREMENTS:

- Data base presently exists: see "REACT User's Guide" Section V
- Typically 1 minute or less response time per query
- 10 seconds CPU time per model cycle
- 4-8 hours learning time for users, depending on complexity of results desired
- 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Participated in two large studies and several exercises. The system is also being used continually as a training device for a number of Federal civilian agencies.

USERS:

- Principal: Federal Preparedness Agency
- Other: Federal non-defense departments and agencies with emergency responsibilities under Executive Order 11490, 28 October 1969

POINT OF CONTACT: MCL/FPA - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory (EDM)
Federal Preparedness Agency, GS Building
Washington, D. C. 20405
Telephone: 566-0912

MISCELLANEOUS:

- It is currently planned to improve the operating capability of the REACT model by reducing core requirements and improving real time response while expanding the operational data base.

KEYWORD LISTING: Analytical Model; Training Model; General War; Damage Assessment/Weapons Effectiveness; Computerized; One-Sided; Deterministic; Event Store; Vulnerability Analysis

TITLE: READY Model

PROPONENT: Federal Preparedness Agency, General Services Administration (FPA/GSA)

DEVELOPER: Mathematics and Computation Laboratory, FPA/GSA

PURPOSE: READY is a computerized, nuclear attack damage assessment model designed to provide an adequately realistic simulation of a hypothetical post-attack situation as a basis for preparedness exercises and planning. It is intended to simulate the effects of a nuclear exchange on the resources, including population, of one adversary. From explicit information on weapon detonations, winds and the location and availability of resources, READY assesses the direct (prompt) effects and fallout radiation levels for all points of concern and estimates the expected damage or casualty level. From these estimates, the expected surviving population and facilities are developed in summary form. For large data categories, stratified samples or selected subsets can be developed to provide rapid assessment of national resource totals.

GENERAL DESCRIPTION: READY is a one-sided, deterministic model capable of considering individual resource locations if desired and capable of aggregating up to a worldwide scale. Although designed primarily for use with the extensive FPA data bank on the US, the model can operate worldwide with appropriate input data. Probability theory is the primary solution technique used. Simulated time is treated on an event store basis.

INPUT:

- Nuclear weapons data: yield of warhead, height of burst, time of detonation, fission ratio, actual ground zero or designated ground zero with the circular error probable, and wind data
- Pre-attack status of resources data: available in FPA files (three million records organized into 110 categories), maintained for the most part in the READY format. The essential ingredients for the resource data are geographic locations, physical vulnerabilities of each data item, and value quantifications indicating the significance of the items within their resource categories.

OUTPUT: The two basic types of output are point estimations and summary analyses. Generally, point estimations show pre-attack information together with estimates of post-attack status. Summaries include time-phased population conditions and availability of facilities, special presentations of items requiring unique assumptions of vulnerability (e.g., livestock, crops, and manpower) and special comparisons of local time-phased supply requirements as the basis for deriving apparent deficits in housing and medical service. The levels of aggregation in these summaries may provide for geographical totals such as an FPA region, in an individual state or individual standard metropolitan statistical areas or functional tools.

MODEL LIMITATIONS: READY reflects only the direct effect of blast, fireball gamma and thermal radiation, and fallout radiation. The effects of prevailing cloud cover, fire or firespread in the areas affected by the blast, earth shock, electromagnetic pulse and induced radiation are not considered.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII (UNIVAC)
- o Minimum Storage Required: 65K (UNIVAC)
- o Peripheral Equipment: Honeywell Page Printer System and UNIVAC 9300 Card Reader and Printer

SOFTWARE:

- o Programming Languages: FORTRAN V (UNIVAC 1108)
- o Documentation:

UNIVAC 1108 Technical Documentation:
(1) READY I - Weapons Preparation Program GSA/OP/MCL TM-234, Rev. 1, Nov 1974
(2) READY I - Attack Conditions Program, GSA/OP/MCL TM-234, Rev. 1, Nov 1974
(3) READY I - Weapons Effects Program GSA/OP/MCL TM 231, Rev. 1, Nov 1974
(4) READY I - Point Analysis Program GSA/OP/MCL TM-232, Dec 1974
(5) READY I - Summary Analysis Programs GSA/FPA/MCL TM-233, June 1976
(6) READY I - Selector Program GSA/OP/MCL TM-247, Dec 1974

TIME REQUIREMENTS:

- o The existing data base is described in "Resource Data Catalog," GSA/FPA/MCL TM-258, Feb 1976
- o Time to structure data in model input format varies with the requirements of the study in hand.
- o CPU time per model cycle is highly variable, ranging from minutes to many hours, depending on the problem under consideration.
- o Days to weeks to analyze and evaluate results, depending on the scope of the exercise or study.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 15 to 25 times per year

USERS:

- o Principal: Federal Preparedness Agency
- o Other: DCPA and other federal non-defense department and agencies with emergency responsibilities under Executive Order 11490, 28 Oct 1969

POINT OF CONTACT: MCL/FPA - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory (EDM)
Federal Preparedness Agency, GS Building
Washington, D. C. 20405
Telephone: 566-0912

MISCELLANEOUS:

- o READY can use weapon assignments from the Attack Generator Model.
- o READY provides attack residuals for the INFERS Model.
- o It is currently planned to add more local supply/requirement comparisons, programmed assignment of local viability dates, and network analyses to the model.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Nuclear Forces; Computerized; One-Sided; Deterministic; Event Store; Vulnerability Analysis

TITLE: RISK II

PROPONENT: Federal Preparedness Agency, General Services Administration (FPA/GSA)

DEVELOPER: Mathematics and Computation Laboratory, FPA/GSA

PURPOSE: RISK II is a computerized, nuclear attack assessment model designed to facilitate the production of "hazard" studies which provide emergency planners with comprehensive characterizations of the impact of contingencies created by nuclear attacks. Hazard studies establish best-to-worst characterizations of the spectrum of estimated effects of nuclear attack or post-attack survival conditions pertinent to planning contingencies. In each case, the spectrum presumes to cover the range of plausible effects/conditions considering enemy offensive capabilities used in the study. Alternative nuclear attacks, i.e., options, are devised to represent varying possibilities with respect to the initiation of a nuclear war. For each option, a series of outcomes (trials) is gamed through the Monte Carlo program of RISK II. The heart of the model is the "Point Experience Computation" wherein for each trial, nuclear effects are computed for geographic reference points and their associated resource categories. These effects include blast overpressure, fallout radiation intensity, time of first fallout arrival and equivalent residual dose. The results for all trials and reference points make up the "Point Experience Library" and provide the basic profile of the possible range of nuclear effects which may be anticipated. Physical vulnerability and shelter protection factors are applied to the spectrum of nuclear effects resulting in point analysis and summary analyses probability ranges which are essential for nuclear contingency planning.

GENERAL DESCRIPTION: RISK II is a one-sided, stochastic model capable of considering resource points on an individual basis if desired, and of aggregating up to a worldwide level. Although designed primarily for use with the extensive FPA data bank on the US, the model can operate anywhere in the Northern Hemisphere with the appropriate input data. Monte Carlo and probability theory are the primary solution techniques used.

INPUT: Weapon application lists for each option with nuclear detonation data, trial structure specifications and resource data.

OUTPUT:

- o For various geographic reference points, selected probable results of basic nuclear effects are recorded in various formats. The most extensive application of this type provides probable effects for several thousand representative reference points organized alphabetically by cities within counties within states by FPA regions.
- o Summary analyses provide the planner with a prospective best-to-worst range of resources available after a nuclear attack. A routine is also available to develop a probable range of local, time-phased, supply requirement comparisons which indicate prospects for a surplus or deficit in such items as medical service and housing and time-phased casualties.

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MODEL LIMITATIONS: The weapon application list is limited to 3,000 weapons per option. Since the relative numbers of trials determine the relative weighting of the options, each option is given sufficient trials to provide representation of the principal variables (circular error probable, probability of arrival and wind season). In past studies, trials per option have ranged from eight to twenty. A discussion of the statistical reliability of RISK II is in National Resource Evaluation Center (NREC) Technical Report No. 22, "An Analysis of the Reliability of the RISK II Computer Statistical Model." Tables of confidence levels are given in the documentation. (Nculear Attack Hazard in the United States - 1974 (HAZARD-74) is in preparation.)

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII (UNIVAC)
- o Minimum Storage Required: 64K
- o Peripheral Equipment: UNIVAC 9300 Card Reader and Printer, and Honeywell Page Printing System

SOFTWARE:

- o Programming Languages: FORTRAN V (UNIVAC 1108)
- o Documentation: NREC Technical Report #11, RISK II NREC Vulnerability Analysis Computation System, June 1965 (in revision)
- o Documentation of the RISK II computer routines is currently being prepared for the programs which have been converted to the UNIVAC 1108.

TIME REQUIREMENTS:

- o Approximately 1-2 weeks with current data base; approximately 1 month to acquire and structure a new data base
- o CPU time per model cycle is a matter of hours.
- o Days to weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Major studies: HAZARD-69, HAZARD-74

USERS:

- o Principal: Federal Preparedness Agency
- o Federal non-defense departments and agencies with emergency responsibilities under Executive Order 11490, 28 October 1969

POINT OF CONTACT: MCL/FPA - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory (EDM)
Federal Preparedness Agency, GS Building
Washington, D. C. 20405
Telephone: 566-0912

MISCELLANEOUS: RISK II takes weapon assignments from the Attack Generator Model.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Nuclear Forces; Computerized; Stochastic; Vulnerability Analysis

TITLE: SAMEM Sustained Attrition

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: SAMEM is a computerized, analytical model that evaluates the effectiveness of a mine plan that includes mine choice and field design. The primary problem addressed is that of demonstrating the capability of a minefield of causing casualties and of identifying that which would need to be done to the minefield if it did not perform as advertised. It can also be used to test mine countermeasure (MCM) tactics.

GENERAL DESCRIPTION: SAMEM is a two-sided, stochastic model involving mining and influence minesweeping. It is designed to consider individual mines, individual ships and specific mine settings, and can aggregate up to any level for the normal minefield. Simulated time is treated on an event store basis. Monte Carlo simulation is the primary solution technique used.

INPUT: All data relative to the mines countermeasures and traffic ships, e.g., mine sensitivity, charge weight, ship speed, displacement, number of mines, placement, countermeasure data, etc.

OUTPUT:

- o Number of casualties
- o Number of mines fired
- o Level of damage to each casualty

MODEL LIMITATIONS: Relative to its use, the model has no limitations

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE
- o Minimum Storage Required: 33K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a Command Manual and an Input Guide, but neither user's documentation nor technical documentation is complete.

TIME REQUIREMENTS:

- o 2 days to acquire base data
- o 1 man-day to structure data in model input format
- o Average of 5 seconds CPU time per model cycle
- o 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice per year

USERS: NSWC for COMINWARFOR

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 703/663-7406 or 663-8645

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: SATAN III - Simulation for the Assessment of Tactical Nuclear Weapons

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis & Gaming Agency (OJCS/SAGA)

DEVELOPER: Anagram Corporation

PURPOSE: SATAN III is a computerized, analytical model designed as a tool for two-sided operational war gaming in the context of a large tactical nuclear war. It can also be used for parametric studies to tactical nuclear weapons systems operations. SATAN III will automatically deploy forces, acquire targets, assign nuclear weapons of fire on those targets, and assess the effects of those fires on personnel and troop equipment. The capabilities of the weapons and the status of the targets are updated whenever delivery systems are committed to firing missions, weapons are expended, and damage is inflicted.

GENERAL DESCRIPTION: SATAN III is a two-sided, stochastic model involving land forces and air forces, the latter in a secondary role as deliverer of air-delivered weapon systems. The smallest grouping that the model was primarily designed to consider is artillery units at the section level (one launcher/unit), and combat units at the company level (this could also be a platoon). Combat and support units may be aggregated to the battalion level but this magnifies error in the assessment of damage. The model is chiefly designed to consider groupings as large as divisions, corps and armies, all of which are described by one or more stylized target complexes (combination of units). Alterations of these levels of forces may influence the interpretation of the conflict environment size. Simulated time is treated on the basis of a timed event-sequence. Random numbers provide the primary solution technique.

INPUT:

- o Weapon system characteristics, target characteristics and the groupings of associated targets into stylized target complexes.
- o For the game scenario: theater force strength and deployment, described by stylized targets, complexes, personnel postures within target areas, weapon employment doctrine, probabilities of target acquisition, probabilities of acquisition of launchers which have just fired, error factors in intelligence functions, and a decision table which triggers a structured set of actions for a given set of conditions.

OUTPUT:

- o Computer printouts of summary reports (format may be controlled by user):
  - o Actual ground zeros
  - o Damaged targets
  - o Status of every target in game and a summary of division, corps and army
  - o Weapon allocation
  - o Target acquisition

- o There is also a plot capability for sector summary bargraphs, geographic plots of theater, division, corps or army overlay with an area enlargment feature.
- o Selective data retrieval and basic matematical operations (+,-,x,÷) permit automated analysis of results of the conflict

MODEL LIMITATIONS:

- o 10 Sectors
- o 400 Units
- o 100 Complex Types
- o 200 Target Types
- o 2000 Total Complexes
- o 200 Target Priorities
- o 50 Weapon Types
- o 100 Launcher Types
- o 5 Acquisition Zones
- o 15 Deployment Areas

HARDWARE:

- o Computer: Honeywell Information System 6000 Series Computer
- o Operating System: GCOS
- o Minimum Storage Required: 90K
- o Peripheral Equipment: CalComp Plotting System 780/718

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Users Manual; Computer Operations Manual; Program Maintenance Manual

TIME REQUIREMENTS: For a Corps size simulation

- o Assemble data base - 1 man month
- o CPU time per run - 1 hour
- o Analyze results - 1 man month

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly

USERS: SAGA

POINT OF CONTACT: Special Studies Division (SSD)
Studies, Analysis, and Gaming Agency (SAGA)
Office of Joint Chiefs of Staff (OJCS)
The Pentagon, Washington, D.C. 20301
Telephone: OX 5-9003

MISCELLANEOUS:

- SATAN III will supersede SATA II, which is presently programmed in the IBM system for use on the IBM 360/50 and IBM 360/65.
- The SATAN III output deck of AGZs, fed to the NMCSSC conversion programs, produce deck inputs for the Single Integrated Damage Analysis Capability model or the Tactical Damage Evaluation Model which damage assess civilian population in the area of conflict.

KEYWORD LISTING: Analytical Model; Limited War; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Mixed Time Step/Event Store

TITLE: SEACOP - Strategic Sealift Contingency Planning System

PROPONENT: Military Sealift Command

DEVELOPER: Navy Regional Data Automation Center (NARDAC)

PURPOSE: SEACOP is a general war, limited war, politico-military situations, and logistics model which provides a computerized technique for determining the shipping resources needed to meet the cargo, troop and POL sealift requirements. It determines the minimum numbers of various ship assets required to meet predetermined time-phased sealift requirements to overseas ports from a variety of shipping origins and movement schedules. SEACOP also addresses the impact of port clearance/throughput capability on ship turn-around time.

GENERAL DESCRIPTION: SEACOP is one-sided and deterministic and involves both land and sea forces. It considers detail to level of individual units and ships, but the purpose of the system is to process data too voluminous for manual analysis. The SEACOP exercise considers 15-20 tons of requirements, 20-30 million barrels of POL, 700-800 ships and 50 ports. There is no limit on the number of input requirements or ships which can be handled. Simulated time is treated on an event store basis. Network analysis and queuing theory are the primary solution techniques.

INPUT:

- o Time phased force deployment data
- o Resupply (cargo and bulk POL)
- o Ports of origin
- o Dates ready to load
- o Ports of destination
- o Required delivery dates
- o Number of berths available to military
- o Amount of port capacity available to military
- o Channel depths

OUTPUT:

- o Ship schedules showing loading/discharging schedules and listing the requirements carried
- o Movement schedules for each OPLAN line number
- o Summaries of requirements scheduled, delivered, attrited, and flagged by type requirement and by time frame
- o Summaries showing actual values and percentages
- o Port workload summaries showing number of ships and amount of requirements by type by day.
- o All reports are standard
- o Only option is whether or not the movement schedules are to be punched into cards

MODEL LIMITATIONS:

- o Port of origin/destination matrix limited to 50 combinations

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HARDWARE:

- o Computer: Honeywell 6000 (WWMCCS)
- o Operating System: GCOS
- o Minimum Storage Required: 40,000
- o Peripheral Equipment: 3 tape drives, 1 printer, 1 reader, 1 remote terminal (HIS 7705 CRT; card reader; HIS 716 central computer)

SOFTWARE:

- o Programming Language: COBOL/FORTRAN
- o Documentation: Completion of documentation by September 1977

TIME REQUIREMENTS: N/A

SECURITY CLASSIFICATION: UNCLASSIFIED to TOP SECRET

FREQUENCY OF USE: 4 times per year

USERS: Military Sealift Command

POINT OF CONTACT: Commander, Military Sealift Command
ATTN: M-61 Mr. Ed Krochalis
Washington, D. C. 22448
Telephone: Autovon 292-2911
Commercial 202/282-2911

MISCELLANEOUS: JCS JOPS-DEPDA file supplies input requirements to SEACOP. MTMT MATCH system CONUS movement cards on tape are also input.

KEYWORD LISTING: Computerized; Analytic; General War; Limited War; Politico-Military Situations; Logistics; Land Forces; Sea Forces; Event Store; One-Sided; Deterministic

TITLE: SEALIFT

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Center for Naval Analyses

PURPOSE: SEALIFT is a computerized, analytic model of limited war which measures the battle between a convoy system with protective ASW forces against a submarine force opposing it. Deliveries and losses of various types are calculated.

GENERAL DESCRIPTION: This two-sided stochastic model deals with land and sea forces (primarily one convoy and one submarine). Time is treated in the vent store mode. It's primary role is to measure the effectiveness of an ASW force assigned to protect a convoy system resupplying a country under attack.

INPUT:

- Forces
- Weapon effectiveness
- Engagement probability
- Exchange ratios

OUTPUT:

- Printout of mean results with standard deviations
- Printed quantities include deliveries, losses and losses of combatants
- Output can be by day or cumulative

MODEL LIMITATIONS:

- Model is basically a bookkeeping device with no physical calculations.

HARDWARE:

- Computer: CDC 3400/IBM 7090

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: CNA NWG Study 47, App. F

TIME REQUIREMENTS:

- Structure base data: 1/2 man-month
- CPU Time: minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: Chief of Naval Operations, OP-96

POINT OF CONTACT: Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia 22209
Telephone: 703/524-9400

KEYWORD LISTING: Analytic; Limited War; ASW; Computerized; Two-Sided; Event Store

TITLE: SEER III - Simplified Estimation of Exposure to Radiation (second modification)

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Stanford Research Institute

PURPOSE: SEER III is a computerized single nuclear burst fallout model that was designed for fallout damage assessment purposes. The design requirements were that it require a short computer execution time and that its output fallout exposure patterns simulate those of the DELFIC fallout model for the same inputs.

GENERAL DESCRIPTION: SEER III is a computerized single nuclear burst fallout mode that will produce fallout dose and dose rate patterns for weapon yields in the range from 0.01kt to 100mt, for various burst altitudes, and various winds aloft. SEER III only requires a few seconds of CDC 6400 computer execution time per run.

INPUT:

- o Total weapon yield
- o Fission fraction
- o Height of burst
- o Wind speeds and directions at various altitudes

OUTPUT:

- o Exposure dose rate patterns
- o Exposure dose patterns from time of fallout arrival to any user specified time

MODEL LIMITATIONS:

- o Weapon yields from 0.01kt to 100mt
- o Surface and above surface bursts only

HARDWARE:

- o Computer: CDC 6400
- o Operating System: Batch
- o Minimum Storage Required: 120K
- o Peripheral Equipment: none

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation Identification: "SEER II: A New Damage Assessment Fallout Model," DNA 3008F, May 1972. Supplemental Users Instructions for SEER III not formally documented, but are available with program.
- o Documentation Availability: Distribution unlimited, DDC No. AD 754144

TIME REQUIREMENTS:

- o Prepare Inputs: Nominal
- o CPU Time per Cycle: 2 to 10 seconds
- o Data Output Analysis: Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used from time to time for various studies at SRI where fallout is part of the research problem. Also being used by other defense oriented organizations.

PRINCIPAL USER: Stanford Research Institute

POINT OF CONTACT: For information - Mr. Paul W. Wong
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: 415/326-6200

For Computer Program: Mr. Joseph Maloney
U.S. Army Ballistic Research Laboratories
Aberdeen Proving Ground, Maryland 21005

MISCELLANEOUS:

- o SEER III has been incorporated into DACOMP. "Damage Assessment Computer Program," to efficiently assess fallout damage from very large numbers of nuclear detonations.

KEYWORD LISTING: Fallout; Nuclear War; Damage Assessment; Radiation; DELFIC

TITLE: SEM - Helicopter Sortie Effectiveness Model

PROPONENT: US Army Combined Arms Combat Developments Activity

DEVELOPER: Combat Operations Analysis Directorate

PURPOSE: SEM is a computerized, analytical, limited war model used to assess the effectiveness and survivability of an atttack helicopter team (AHT) on a per sortie basis. SEM summarizes AHT effectiveness and survivability versus an armored threat battalion with Air Defense (AD) capabilities based on Helicopter Individual Engagement Model outcomes.

GENERAL DESCRIPTION: SEM is a two-sided, deterministic, first-order attrition model involving both land and air forces. The level of aggregation for this model considers one AHT with scouts versus threat company. The largest combination of units the model considers is multiple AHT or AH task force versus battalion threat with AD. Outcomes may be extrapolated to larger areas of consideration. Simulated time is treated on an event store basis. SEM employs game theory and queuing theory to predict player losses as a function of battle time.

INPUT:

- o IEM outputs
- o AHT mix
- o Threat AD mix
- o AH/Scout standoff ranges
- o Threat array density and approach velocity
- o AHT laser designation option (autonomous and Scout or ground remote)

OUTPUT:

- o AH/Scout losses
- o AH missile expenditure
- o Threat target losses (including AD)
- o Sortie durations

MODEL LIMITATIONS:

- o Independent and constant event probabilities
- o Constant AH/Scout relocation and FARRP transit times
- o Uniform threat density

HARDWARE:

- o Computer: CDC 6400/6500
- o Operating System: SCOPE
- o Minimum Storage Required: 65K words
- o Peripheral Equipment: Card reader, printer, CRT terminal for interactive play

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Planned to be published as an appendix to the AH-IS/ITV Force Structure Analysis (AFSA) Report OAB June 1977
- o User's documentation is not complete.
- o Technical documentation is complete.

TIME REQUIREMENTS:

- o Time for IEM outputs
- o 1 week to structure data in model input format
- o Less than 5 CPU minutes per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Source Code UNCLASSIFIED

FREQUENCY OF USE: 5-10 times per year

USERS:

- o Principal: USA Combined Arms Combat Developments Activity

POINT OF CONTACT: Dr. L. Pfortmiller
Combat Operations Analysis Directorate (ATCA-CAT)
USA Combined Arms Combat Developments Activity
Ft. Leavenworth, Kansas 66027
Telephone: Autovon 552-5140

MISCELLANEOUS: SEM uses output summary directly from IEM runs. The outputs have been used in the CACDA Scores Jiffy Game.

KEYWORD LISTING: Computerized; Analytical; Limited War; Land Forces; Air Forces; Two-Sided; Deterministic; Event Store

TITLE: SIDAC - Single Integrated Damage Analysis Capability

PROPONENT: Studies, Analysis, and Gaming Agency, Organization of the JCS

DEVELOPER: Command and Control Technical Center, DCA (CCTC)

PURPOSE: SIDAC is a computerized analytical model designed to provide nuclear damage analysis information for both the Red and Blue resource monitoring subsystems of the General War System at the ANMCC. SIDAC is a modularly designed system with expandable capabilities that will fulfill user requirements for nuclear damage assessment in the operational environment and vulnerability analysis in planning support studies. SIDAC's modularity feature provides for rapid incorporation of state-of-the-art advances and adaption for unique needs.

GENERAL DESCRIPTION: SIDAC is a one-sided model that simulates land, air, and sea forces, as well as civilians and paramilitary. It can consider weapons or weapons systems individually and the modularity of its design allows the user to aggregate up to any level he wishes, depending upon his specific requirements. Simulated time is treated on an event store basis. The model uses a mixture of deterministic and stochastic elements. Probability is used as the primary solution technique for prompt damage by means of the methodology developed by the Physical Vulnerability (PV) Division of the United States Air Force Intelligence. Delayed radiation effects are estimated by means of the methodology developed by the Weapons Systems Evaluation Group (WSEG).

INPUT: Input is required for three files designated as target, weapon, and wind, respectively, as follows:

- o The basic CCTC source of target information for damage assessment vulnerability analysis studies is the 336 character Joint Resource Assessment Data File (JAD). The JAD format is not the only format the SIDAC system will accept since the user can format his own input file. A complete description of the JAD can be found in Joint Chiefs of Staff, JCS Pub 6.

- o Input into the weapons file consists of two standard type reports; strike (used to describe a weapon that has arrived and detonated or a weapon that was launched successfully) and error (used to delete the effects of a previously reported strike).

- o Input into the wind file originates from the Global Weather Central (GWC), Offutt AFB, Nebraska, and consists of wind speed and direction at five different pressure surfaces.

OUTPUT:

- o Hardcopy output is prepared from a SIDAC created file by use of the output features of compilers (e.g. COBOL, FORTRAN). Basic procedures are provided to help the user in translating the basic effects information into more meaningful terms.

MODEL LIMITATIONS:

- o Target base contains only static targets. Moving targets are not taken into account.
- o Targets must be assigned a VN number to calculate prompt damage.
- o Fire ignition and spread, as well as communications blackout modules, are not available.

HARDWARE:

- o Type Computer - HIS/6000
- o Operating System - GCOS
- o Minimum Storage Required - 36K words of core storage
- o Peripheral Equipment - Card reader, printer, magnetic tape handler 9 channels (optional) and at least one disc storage unit

SOFTWARE:

- o Programming Language - FORTRAN
- o Documentation: Available from the Defense Documentation Center using the AD numbers listed with each title.
  Functional Description (UNCLASSIFIED), SPM FD 7-73, (AD 910 614L).
  Test and Implementation Plan (UNCLASSIFIED), SPM PT 7-73, (AD 912 420)
  Users Manual (UNCLASSIFIED), CSM UM 67-74, (AD 922 212L)
  Description of Mathematics for the Single Integrated Damage Analysis Capability (SIDAC) (UNCLASSIFIED), TM 15-73, (AD 913 164L)
  Advanced Single Integrated Damage Analysis Capability (SIDAC) Concepts, (UNCLASSIFIED), TM 91-74, (AD 921 242)

TIME REQUIREMENTS:

- o Prepare Data Base - variable
- o CPU Time per Cycle - variable
- o Data Output Analysis - variable

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Over 600 times per year

USERS: Studies, Analysis, and Gaming Agency, Survivability Office of the Defense Communications Agency, Deputy Director for Strategic Programs, Defense Intelligence Agency, Defense Program Analysis and Evaluation, USREDCOM, CINCLANT, CINCPAC and US ARMY

POINT OF CONTACT: Defense Communications Agency
Command and Control Technical Center
The Pentagon, Washington, D.C. 20301
Telephone: OX 53521

MISCELLANEOUS: Use as the nuclear damage analysis portion of the GENERAL WAR SYSTEM

KEYWORD LISTING: Nuclear; fallout; radiation; assessment; fatalities; casualties; weapon effects; prompt effects; residual effects; mathematical model; computer simulation

TITLE: SIGMALOG I - Simulation and Gaming Methods for Analysis of Logistics, Part I: Requirements Analysis System

PROPONENT: U.S. Army Deputy Chief of Staff for Logistics (DCSLOG)

DEVELOPER: General Research Corporation

PURPOSE: SIGMALOG I is a set of computer-assisted, analytical logistics models used to test the logistic feasibility of contingency plans, including the adequacy of stock levels specified, transportation capacities and capabilities, maintenance capabilities, and construction of facilities. The primary focus of concern is on time-phased logistic requirements to support the forces involved in an operation/contingency plan or study, including combat service support units, materiel, maintenance, transportation, and construction. In addition, the model may be used to determine time-phasing and adequacy of combat service support units on a troop list, hospital bed requirements, and personnel replacements.

GENERAL DESCRIPTION: SIGMALOG I models are deterministic. The types of forces involved may be land, air, paramilitary, and/or civilian. It is capable of considering one US Army platoon or team or equivalent USMC/USAF units, if desired, and of aggregating up to the level of theater level or worldwide forces. Simulated time is treated on a time step basis.

INPUT: Time-phased force deployment list data, Allied Forces data, local labor data, scenario, tactical matrix, PW policy, hospital policy, evacuation policy, supply stockage policy, supply network, maintenance policy, transportation policy, transportation network, construction policy, refugee policy, personnel replacements policy.

OUTPUT: Computer printouts reduced to summary format, e.g., tables, matrices, and two-dimensional graphic displays, or variations as desired such as detailed reports or selective retrievals.

MODEL LIMITATIONS: 30 grouping of personnel, 30 categories of personnel using materiel or requiring support, 20 categories of materiel, 20 time periods, 20 regions, 5 modes of transportation.

HARDWARE:

- o Computer: CDC 6400/IBM 7094/UNIVAC 1108
- o Minimum Storage Required: 32,000 words
- o Peripheral Equipment: Printer, 12 tape drives, and disk storage

SOFTWARE:

- o Programming Languages: FORTRAN, COBOL
- o Documentation: Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- o Presimulation Phase: 1 month
- o Simulation Phase: 3 months
- o 13 hours CPU time per cycle
- o Post Simulation Phase: 2 months

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Total system once per year; selected models, as required

USERS: U.S. Army Logistics Evaluation Agency

POINT OF CONTACT: U.S. Army Logistics Evaluation Agency
Planning and Operations Research Division
New Cumberland Army Depot
New Cumberland, Pennsylvania 17070
Telephone: Autovon 977-6742

MISCELLANEOUS:

- o SIGMALOG I can be linked by automated interface to U.S. Army Engineer Study Group Model Computer-Assisted System for Theater-Level Engineering (CASTLE) and the U.S. Army Concepts Analysis Agency theater round out model FASTALS.
- o Improvements and modifications are made as requirements dictate.

KEYWORD LISTING: Logistics; Deterministic; Time Step; Computer-Assisted

TITLE: SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics, Part II: Capability Analysis System

PROPONENT: U.S. Army Deputy Chief of Staff for Logistics (DCSLOG)

DEVELOPER: General Research Corporation

PURPOSE: SIGMALOG II is a computer-assisted, logistics capabilities analysis system that compares time-phased Army logistic resources with time-phased deployment and resupply requirements determined by SIGMALOG I for combat service support units, major end items, intertheater transportation, and ammunition for the support of one to three contingency plans.

GENERAL DESCRIPTION: SIGMALOG II accepts logistic requirements for up to three theaters, and together with analyst inputs, compares these with the logistic resources recorded in Army data files in order to identify the Army's logistic capability in the four resource areas listed above. The term "time-phased" refers to the requirements in each of the (up to 20) distinct time periods into which a contingency plan is divided in SIGMALOG I. Since SIGMALOG II can accommodate up to three theaters, time periods overlap and a maximum of 36 time periods may be used.

INPUT: Time-phasing requirements of the three theaters, current assets, and future availability of assets. All major inputs are tape files produced by SIGMALOG I and drawn from Army resource files.

OUTPUT: Computer printouts stating by combat service support unit (standard requirements code), major end item (line item number), ammunition by round (DOD ammunition code), and transportation carrier, the number required, available, and the differences by time period.

MODEL LIMITATIONS:

- 12 commodities
- 12 carriers
- 36 time periods
- 3 theaters
- There are no restrictions on the number of CSS units, major end items, or types of ammunition rounds.

HARDWARE:

- Computer: CDC 6400, three modules on IBM 7094, UNIVAC 1108
- Minimum Storage Required: Three modules - 32,000 words
One module - 65,000 words
- Peripheral Equipment: Printer and four tape drives

SOFTWARE:

- Programming Language(s): FORTRAN and COBOL
- Documentation: CDC related manuals -- The paper, "Simulation and Gaming Methods for Analysis of Logistics, Part II (SIGMALOG II): Capability Analysis System," RAC-TP-432, dated August 1971, (AD 888044L), by Richard C. Robinson et al, is the complete documentation
- The above represents both complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- o Provided that SIGMALOG I generated requirements are available, one month to analyze and evaluate results.
- o 5 hours CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS: U.S. Army Logistics Evaluation Agency

POINT OF CONTACT: U.S. Army Logistics Evaluation Agency
Planning and Operations Research Division
New Cumberland Army Depot
New Cumberland, Pennsylvania 17070
Telephone: Autovon 977-6742

MISCELLANEOUS:

- o SIGMALOG II uses the following four SIGMALOG I models: Force Employment, Major Item Resupply, Ammunition Resupply, and Transportation. Data is transmitted via magnetic tape.

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Computer Assisted; Deterministic; Time Step; Linear Programming

TITLE: SIM II

PROPONENT: Chief of Naval Operations, OP-095

DEVELOPER: Electric Boat Division of General Dynamics

PURPOSE: SIM II is a computerized, analytical, limited war model. It models detailed and rigid naval warfare situations. The program is completely precompiled, such that any desired situation can be simulated through the use of input data, without any programming. The model is designed to focus on primarily naval warfare tactical situations, especially submarine warfare situations. It also is used for the transfer of tactical information between platforms.

GENERAL DESCRIPTION: SIM II is a two-sided, mixed model dealing with air and sea forces, and primarily designed for modeling the submarine in direct support of a task force. The model considers one versus one platform up to one versus eighteen platforms and task force size groups. Simulated time is treated on an event store basis. Monte Carlo simulation is the primary solution technique used. Information exchange, however, is not treated as a stored event. Whenever information exchange can occur, the sampling interval is adjusted to a value that will accommodate the measure of information exchange. Accurate modeling is achieved in the presence of mutual interference among elements.

INPUT:

- o The input data is grouped into two categories. The first includes the description of the environment and the element.
- o The second outlines the tactical responses of the elements based upon their available information.
- o The model has been designed to accept tactical input data in a specially developed format. This format includes English vocabulary words in a sentence-like structure, accompanied by numerical data. The structure is easily readable, and the commands that the words represent are pre-programmed to minimize the effort required in setting up a tactical situation. The words are also analogous to the commands that would be given to a navigator, helmsman, or fire-control party, so the interpretation of the tactical situation is as direct as possible.
- o The model also utilizes input describing the operating medium. In the case of submarine simulation, this is concerned largely with sonar transmission losses that are functions of the depths of source and receiver.

OUTPUT: There are three basic types of output data available. The first is a time history of the events simulated and is available over a wide range of detail on a selective basis. It can provide, in complete sentence structure, the situation with respect to each ship at each time step in the program. The second type is a tabular output data at those times when significant scales and other pertinent data are provided. The third type of output is statistical, and it includes histograms, graphs, means, standard deviations, percent of occurrences, and tallies of significant events and cases. This feature is particularly useful in evaluating tactics and in forming the basis for decisions.

MODEL LIMITATIONS:

- The number of platforms used by the model is limited by computer core size.
- The current model in use takes 48,000, 32 bit words and provides approximately 18 platforms.

HARDWARE:

- Computers: UNIVAC 1110, UNIVAC 1108, CDC 6700, HONEYWELL 635
- Minimum Storage Required: 48,000, 32 bit words

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: General Dynamics Corporation, Electric Boat Division, Report U440-76-018, 1 March 1976, VOL I and II
- User and technical documentation available
- Documentation contains typical examples

TIME REQUIREMENTS:

- Various months required to acquire base data
- 0.5 man-months to structure data in model input format
- 30 seconds (UNIVAC 1108, 1110) CPU time per model cycle
- 0.75 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2-3 times per year

USERS:

- Principal: COMSUBDEVRON Twelve
- Others: US Naval Academy, COMSUMPAC, Naval Underwater System Center, New London, NSRDC

POINT OF CONTACT: Mr. Thomas Downie
General Dynamics Corporation
Electric Boat Division
Groton, Connecticut 06340
Telephone: 203/446-6790

MISCELLANEOUS: This model is not linked to any other models and does not supersede any model. It is planned to add new capabilities to this model to expand the capability of each platform so that it can possess more than one sensor.

KEYWORD LISTING: Analytical Model; Limited War; Air and Sea Forces; Computerized; Two-Sided; Mixed Event; Event Store

TITLE: SIMCE - Simulation - Communications - Electronics

PROPONENT: USA Signal School, Fort Gordon, Georgia 30905

DEVELOPER: Booz Allen Applied Research, Inc.

PURPOSE: SIMCE is a computerized, analytical model designed to size and analyze a multichannel communications system, given a statement of user requirements communications support requirements (COMSR). The model is used to size army communications as to unrouted and routed requirements for each mode (voice, page, graphic, data). In addition, it is also concerned with communications requirements as a function of user location and user density.

GENERAL DESCRIPTION: SIMCE is a one-sided model having both deterministic and stochastic elements. Only land forces are involved. It is designed to consider groupings ranging in size from an army to a theater. Linear equations are the primary solution techniques used.

INPUT:

- o User communications requirements (COMSR)
- o Unit locations
- o Node locations
- o Node-to-node connectivity
- o Network routing

OUTPUT:

- o Unrouted and routed communications requirements for each mode
- o Local and long distance distribution
- o Security requirements
- o Regression curves for traffic volume as function of number of units at a node
- o Output can be selective retrievals at each stage of processing, such as unrouted and routed communication requirements
- o Communications requirements as a function of user location of user density

MODEL LIMITATIONS: User communications requirements are needed for each force model in use.

HARDWARE:

- o Computer: IBM 360 or CDC 6500
- o Operating System: OS/MVT (IBM); SCOPE (CDC)
- o Minimum Storage Required: 200K bytes
- o Peripheral Equipment: Printer, tape drive, disk, card reader, plotter

SOFTWARE:

- o Programming Language: FORTRAN IV/USA FORTRAN
- o Documentation: SIMCE User's Manual Volume I (AD 880-335), II (AD 880-336), III (AD 880-421), and IV (AD 880-422)
- o Both user's documentation and technical documentation are complete. Technical documentation is part of the user's manual.

TIME REQUIREMENTS:

- o 1 month to initialize communication system configuration
- o 212 minutes CPU time per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: Concepts and Studies Division, DCD, USASIGS, Fort Gordon, Georgia

POINT OF CONTACT: LT Paul M. Stone
Concepts and Studies Division (ATSN-CD-CS-R)
US Army Signal School
Fort Gordon, Georgia 30905
Telephone: Autovon 780-4462

KEYWORD LISTING: Analytical Model; General War; Land Forces; Computerized; One-Sided; Mixed Deterministic/Stochastic

TITLE: SIRNEM - Strategic International Relations Nuclear Exchange Model

PROPONENT: United States Arms Control and Disarmament Agency

DEVELOPER: Academy for Interscience Methodology

PURPOSE: SIRNEM is a computerized, analytical model designed to study strategic force exchanges and interactions. The model simulates various missiles and combers as well as tactical aircraft and satellites.

GENERAL DESCRIPTION: The model is "n"-sided, event store and considers land, air and sea forces. Individual weapons and targets are considered. The model's chief focus is on strategic force effectiveness against counter value and counterforce target systems. Primary solution techniques are LaGrange multipliers, probability and geographic relationships.

INPUT:

- Target coordinates, hardness level, value and identifier
- Weapon coordinates, number, yield, accuracy, reliability and identifier

OUTPUT:

- Computer printout of percent target base destroyed, weapons allocated and collateral effects

MODEL LIMITATIONS:

- Command and control not explicitly simulated

HARDWARE:

- Computer: CDC 6600
- Minimum Storage Required: 220K

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Documentation available from USACDA

TIME REQUIREMENTS:

- 2 man-months to structure data base
- CPU time problem dependent

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 12 times per year

USERS: USACDA, Lawrence Livermore Laboratory

POINT OF CONTACT: Office of Operations Analysis
U.S. Arms Control and Disarmament Agency
State Department
320 21st Street NW
Washington, D. C. 20451

MISCELLANEOUS: A subroutine called AIRPEN to simulate manned bomber penetration and interactions with complex defensive systems is currently under development.

KEYWORD LISTING: Computerized; Strategic; Missile; Bomber; Nuclear; Event Store

TITLE: SITAP - Simulator for Transportation Analysis and Planning

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Computer Sciences Corporation (CSC)

PURPOSE: The SITAP is a computerized, analytical, transportation model designed to give the analyst a broad spectrum of transportation systems. A transportation system, for this purpose, is any system that can be viewed as a network through which vehicles move in order to satisfy movement demands arising at nodes in the network. The movement demands, vehicles, and defined network are controlled by the analyst. SITAP produces cargo and vehicle throughput, depot holdings, and utilization of facilities and manpower.

GENERAL DESCRIPTION: The SITAP is a deterministic model involving airlift and sealift vehicles, transportation networks, and requirements for cargo movement. Requirements may be considered individually or they may be grouped. Numerical analysis is the primary solution technique used.

INPUT: The input source is card images and/or MACE generation of events. Inputs are: (1) the network, (2) parameters, (3) vehicle characteristics and movements, (4) cargo description and quantities, and (5) facilities. Each of these areas may have as many input cards as necessary to complete the problem scenario.

OUTPUT:

- o Traffic generated over each link of the network and simulated flow of cargo through the network
- o Mean response times between cargo ordering and delivery
- o Cargo throughput
- o Vehicle throughput
- o Depot holdings
- o Resource, manpower, and facility utilization
- o Vehicle waiting times, service times, and idle times for each vehicle type and node

MODEL LIMITATIONS: Limitations are directly related to computer core size. The HIS 6080 can accept the following:

- o 20 nodes
- o 10 cargo types
- o 20 vehicle types
- o 15 resources
- o 500 individual vehicles
- o 1000 individual cargo movement requirements

HARDWARE REQUIREMENTS:

- o Computer IBM 360/65 or HIS 6080
- o Operating System OS/MVT for IBM and GCOS for HIS
- o Minimum Storage Required: 350K bytes for IBM 360/65 and 110K words for HIS 6080
- o Peripheral Equipment: Tapes and disk

SOFTWARE:

- Programming Languages: FORTRAN IV, IBM 360/65; FORTRAN Y, HIS 6080
- Documentation: User's Manual, CCTC, 18 January 1971 and Technical Manuals in draft only, CCTC

TIME REQUIREMENTS:

- 1 to 2 weeks to acquire base data
- 1 man-week to structure data in model input format
- 10 minutes to 1 hour CPU time per model cycle
- 1 hour to 2 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USER: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon
Washington, D. C. 20301
Telephone: OX7-3686

KEYWORD LISTING: Analytical Model; Transportation; Logistics; Airlift; Sealift; Nodes; Throughput; Computerized; Deterministic

TITLE: SLATEM - Submarine Launch Assignment, Targeting, and Effectiveness Model

PROPONENT: U.S. Army Ballistic Missile Defense Program Office

DEVELOPER: Stanford Research Institute - Huntsville

PURPOSE: SLATEM is a computerized, analytical, damage assessment/weapons effectiveness model used to design and evaluate a nearly optimum attack by an SLBM force against a time-varying value structure. In the development of this program, emphasis has been given to modeling an attack against the Strategic Air Command (SAC) alert aircraft forces while defended by a BMD system. Determine for some given SLBM threat against a given SAC aircraft base deployment the number of alert aircraft that would escape.

GENERAL DESCRIPTION: SLATEM is a two-sided, deterministic, air/sea force model that was primarily designed to simulate the attack of one SAC base by one submarine. The model may be manipulated to simulate a typical SLBM force versus any SAC aircraft deployment. The level for which the model was primarily designed is 350 launch points, 72 SAC bases, 4 types of aircraft, 16 SLBMs per Sub, 40 Subs. Range of possible manipulation is any combination of above. Sides use a time step in mechanizing the closed-form probabilistic equation.

INPUT: (1) Number of SAC bases; (2) Location of each base; (3) Number of each type of aircraft on alert at each base; (4) Total alert aircraft; (5) Warning time; (6) Decision and communication time; (7) Reaction time; (8) Time to safety; (9) Average time between departures; (10) Departure lag; (11) Number of submarines on station; (12) Number of available SLBMs on each submarine; (13) The SLBM's non-reprogrammable reliability; (14) SLBM launch delay; (15) Number of launch points; (16) Location of each launch point; (17) Minimum SLBM range; (18) Maximum SLBM range; (19) SLBM trajectory time-of-flight coefficients.

OUTPUT: For each submarine in the attacking force, the expected number as well as type of aircraft destroyed.

MODEL LIMITATIONS: In addition to the input limitations as shown above there are two additional: (1) The launch points and target lists are selected sequentially for each submarine rather than simultaneously for all submarines. The difference between sequential and simultaneous selection for the cases considered has been less than 3% of the total SAC alert force; (2) The effects of exhaustion of the defense's interceptor stockpile is not considered.

HARDWARE:

- Type of Computer: CDC 6400
- Operating System: SCOPE 3.4
- Minimum Storage Required: 30,000 words of core

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: SRI memorandum by J. O. Carroll, H. A. Lewis, and W. H. Winter, "Methodology for Evaluating SAFEGUARD SAC Defense Effectiveness: (U), SRD-EG53 (March 1971), SECRET

TIME REQUIREMENTS:

- o Acquire base data: Unknown
- o CPU time per model cycle: Unknown
- o Analyze and evaluate results: Unknown

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: Principal: BMDSCOM
SRI

POINT OF CONTACT: J. O. Carroll (principal contact), W. H. Winter, H. A. Lewis, W. J. Medal
Stanford Research Institute
Huntsville, Alabama
Telephone: 205/837-3050

MISCELLANEOUS: Model(s) to which linked: Analysis of SAFEGUARD Repertoire (ANSR). ANSR is capable of generating a list of SAC bases that can be attacked by avoiding the defense from each SLBM launch point; this list is then input into SLATEM as possible launch points for use against SAC. SLATEM is not a replacement for an existing model. The following modifications are planned for SLATEM: (1) Mix aircraft types on a runway; (2) Mix threat elements; and (3) Add a more efficient means of handling bases which have dual runways.

KEYWORD LISTING: Analytic Model; Damage Assessment/Weapons Effectiveness; Computerized; Two-Sided; Deterministic; Time Step

TITLE: SMOBSMOD - Strategic Mobility Simulation Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: OSD/USAF; USA STAG; USA CAA

PURPOSE: SMOBSMOD is a computerized, analytical, logistics model designed to serve as a strategic mobility (inter-theater) movement capability estimator. The model is primarily concerned with determining the routing and vehicle utilization (any number of vehicle types) that can close a unit most quickly into an overseas theater. In addition, the model is also concerned with node throughput capacities. A pre-processor is provided which can be used to generate movement requirements for resupply and theater supply buildup, and to integrate these into the movement requirements deck at appropriate dates. The impact of attrition of ships and of aircraft due to enemy action is also examined. Convoying is played in a parameterized manner.

GENERAL DESCRIPTION: SMOBSMOD is a one-sided, stochastic model involving air and sea forces. Tonnages and manpower strengths may be aggregated to any level the user desires, from single units to hundreds of units. The model is designed to consider from one to ten simultaneous multiple-theater networks. Simulated time is treated on an event store basis. Simulation-type algorithms are the primary solution technique used.

INPUT:

- Number, type and description of aircraft and ships
- Tonnages, troop strengths, and location of units to be moved
- Distance tables
- Theater supply consumption factors and stockage objectives

OUTPUT:

- Closure profiles, by unit, by theater, and by percentage of total requirements
- Vehicle and node utilization
- Detailed output of the processing of each unit movement
- Vehicle status reports
- Army/other Services analysis of cargo throughput

MODEL LIMITATIONS: Convoying cannot be played discretely.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storate Required: 45K words

SOFTWARE:

- Programming Language: SIMSCRIPT I.5
- Documentation: "Strategic Mobility Simulation Model (SMOBSMOD) - Users Manual." US Army Concepts Analysis Agency, Bethesda, Maryland (June 1974)
- Both user's documentation and technical documentation are complete, except for attrition algorithm. Documentation was prepared for use with the UNIVAC 1108, as of February 1972, and is available only at USA CAA. A SIMSCRIPT I.5 compiler is required.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 5 man-months to structure data in model input format
- Approximately 2 minutes CPU time per 10-unit movement requirements
- 1 month learning time for users
- 1 day to several weeks to analyze and evaluate results, depending on the size of the problem

SECURITY CLASSIFICATION: Input-dependent

FREQUENCY OF USE: 10 times per year

USERS: USA CAA

POINT OF CONTACT: MS. R. A. Brown
US Army Concepts Analysis Agency, MRM
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1683

MISCELLANEOUS: The SMOBSMOD program is currently being refined and converted to the SIMSCRIPT II.5 language.

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Sea Forces; Computerized; One-Sided; Stochastic; Event Store

TITLE: SNAP - Strategic Nuclear Attack Planning System

PROPONENT: Command and Control Technical Center, Defense Communications Agency (CCTC/DCA)

DEVELOPER: CCTC/DCA

PURPOSE: SNAP is a computerized analytical system designed for use in nuclear weapons allocation, nuclear forces requirement studies and blast damage assessment. The chief focus of concern is the achievement of a nuclear stockpile allocation minimizing overkill, maximizing the number of targets killed while minimizing weapon expenditures. This allocation is achievable with or without restraints; using or not using launch areas for weapon systems; and obeying or ignoring restraints/optional with-holds.

GENERAL DESCRIPTION: SNAP is a one-sided deterministic system comprised of five programs, one of which is the allocator, and is designed to consider a wide variety of nuclear weapon arsenals in allocations resulting for user control. Depending on the usage, one allocation run or a number of them may be required to achieve a solution acceptable to the user. If more than one is required, the printed output from a given run will permit an improvement of the achieved solution in the next run. The number of runs required will depend on the nature of the request and the familiarity of the user with SNAPS. The SNAP system will allocate up to thirty weapon systems from up to forty launch areas to JAD type target data bases. The target data bases can be coded or uncoded (minor changes would be required on up to two of the auxiliary preprocessing programs of the system to adapt to any properly prepared target data base). An uncoded data base permits the user to generate attack instructions on the targets in the data base according to their category or subcategory. A coded data base permits the generation of attack instructions according to the resulting pseudocategories and/or tide codes. The primary solution technique used for the determination of the DGZ is a complex multivariable dependent process exercised on a geometric plane resulting from a transformation from a probabilistic one.

INPUT:

- Target base with the information requirements depending upon the task at hand. Minimum requirements per target are: Latitude, Longitude, Radius, VNTK, Point Value, and/or Capacity. For P-95's the capacity is required.
- Weapon system inventory with the information requirements depending upon task at hand. Minimum information per weapon system: Number available, CE, Yield, Height of Burst and Probability of Arrival.

OUTPUT:

- Computer printouts giving a statistical synthesis of the results of the laydown with highly detailed information for further analytical studies of various options.
- Magnetic tape file containing DGZ listing with pertinent information per DGZ. This tape can be used to generate input for SIDAC, DASH, DARCOL, FOZ or others as needed. This listing is also part of the printed output.

MODEL LIMITATIONS:

- o Targets - Only point targets and circular area targets, the latter can be uniform or normally distributed.
- o Weapon Systems - 30
- o Launch Areas - 40
- o Systems within each launch area - 10

HARDWARE:

- o Computer: HIS 6080
- o Operating System: GCOS
- o Minimum Storage Required: 83K
- o Peripheral Equipment: Card reader, disk drives, printer, tape drives

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Strategic Nuclear Attack Planning System (SNAP) - Users Manual NMCSSC - 1975

TIME REQUIREMENTS:

- o Given a data base in JAD format the time from receipt to conversion to SNAP would be less than 3 days. From this converted base any subset will be generated as part of the run to be made by the allocator preprocessor.
- o For first run input time can vary from 20 minutes to 2 days, depending on task at hand.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS:

- o Principal: Studies, Analysis, and Gaming Agency

POINT OF CONTACT: CCTC/C314
Mr. C. G. Thompson
The Pentagon, Room ME688
Washington, D. C. 20301
Telephone: OX-59331

KEYWORD LISTING: Analytical Model; General War; Damage Assessment; System-Launch Areas Allocator, Deterministic, Acceptable Solution; Minimal Weapon Expenditure, Minimal Target Overkill, Maximum Target Destruction per DGZ

TITLE: SPSM - Supply Point Simulation Model

PROPONENT: U.S. Army Logistics Center

DEVELOPER: General Research Corporation

PURPOSE: SPSM is a computerized, analytical logistics model designed to simulate the supply transactions of a supply point (i.e., any organization that receives demands, places orders for supplies, and receives shipments) operating in accordance with prescribed supply policies, and to report the resulting supply performance, workloads, and costs. The primary problem addressed is that of performing comparative analyses of alternative supply policies applied at a single point and of determining their relative merits.

GENERAL DESCRIPTION: The model involves land, air and sea forces. It is primarily designed to consider groups of division size, but may be manipulated to consider groups ranging from company to theater size. The ratio of game time to real time is seconds to years. Simulated time is treated on an event store basis. The model uses sotchastic discrete event simulation as its primary solution technique.

INPUT:

- o Supply policy parameters
- o Demand forecasting parameters
- o Item characteristics and probability distributions for number of demands, quantity demands, and resupply delay time. (NOTE: Assumed input distributions of demand patterns may be employed.)

OUTPUT:

- o Detailed input report
- o Reports of summary performance, workloads and costs for each item and the aggregated items
- o An Output Postprocessor is available to produce histograms, time series and graphs

MODEL LIMITATIONS:

- o Limited to the analysis of the effects of supply policies at a single point

HARDWARE REQUIREMENTS:

- o Computer: CDC 6500 and IBM 7094
- o Operating System: SCOPE 3.4 on CDC 6500
IBSYS on IBM 7094
- o Minimum Storage Required: 17K Decimal words on CDC 6500
32K on the IBM 7094
- o Peripheral Equipment: One external file

SOFTWARE:

- o Programming Language(s): FORTRAN
- o Documentation: H. A. Markham et al, "Supply Point Simulation Model," RAC-TP-437, November 1971 (AD 891-9051)
- o The above document represents both complete user's documentation and technical documentation

TIME REQUIREMENTS:

- o 1-3 months to acquire base data
- o 1 man-month to structure data in model input format (NOTE: Above time requirements do not apply if assumed demand distributions are employed.)
- o Some seconds of CPU time per model cycle
- o 1-3 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS:

- o Principal: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate (ATC-OSA)
Fort Lee, Virginia 23801
Telephone: Autovon 687-4180/3403

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Stochastic, Event Store

TITLE: SSA - Static Sector Analysis Model

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

PURPOSE: This is a computer assisted model for calculating force requirements directly by comparing measures of the combat effectiveness of opposing forces at various points in time after mobilization. The model does not consider movement of units within a theater or FEBA movement, and therefore, it is classified as static, although it does consider the buildup of forces in theater with time.

GENERAL DESCRIPTION: The combat effectiveness of defending forces is calculated for each sector and for the theater reserve. Effectiveness is expressed in terms of Weighted Unit Value (WUV), which is the total worth of all effective weapons in a force; however, any set of force effectiveness indicators could be used. The total WUV of the attacker is determined and an attack axis(es) selected. The amount of defender WUV deployed in sectors off the main attack is determined, and enough attacker WUV is allocated opposite those sectors to fix the defending force in place. That is, the attacker allocates enough force in those sectors to keep the defender from exceeding the stalemate force ratio. This ratio can be varied. The remaining attacker WUV is then assumed to be applied on the main attack sectors and compared with the defender's WUV in those sectors plus in his entire reserve. If the defender does not have enough WUB to keep the attacker from exceeding the stalemate force ratio, a requirement is generated. If the defender has too much WUV, an excess is calculated. The WUV output is translated into a more convenient measure, such as the equivalent WUV in armor divisions (ADEs), to make comparisons easier. This process is repeated at each point in time after M-Day for which results are desired, updating the force deployments to reflect the availability of any additional units in the theater of operations. This model has been used by OASD(PA&E) to estimate US force requirements for Europe and Northeast Asia.

INPUT:

- A battlefield description which includes FEBA location, sector subdivisions within the theater, initial deployment of friendly forces to sectors and theater reserve, and identification of likely attack sectors for enemy forces.
- A set of combat value scores describing the relative contribution of each unit to overall force effectiveness.
- A time-phased deployment/availability schedule for friendly and enemy forces.
- A value for the maximum attacker/defender effectiveness ratio that still allows the defender to hold the attacker on a defensive line (called "stalemate force ratio").

OUTPUT: The output measure of the model is the incremental amount of force effectiveness (+ or -) that a defender would require to stalemate an attacker at a given point in time. Force effectiveness is usually measured in terms of armor division equivalents (ADEs), which is the combat effectiveness score for a standard US armor division.

MODEL LIMITATIONS:

- Geography is not explicitly considered.
- Considers only ground forces.
- Does not consider logistics or combat attrition.
- Is limited to static comparisons.

HARDWARE:

- Computer: IBM 360/50, IBM 360/65, CDC 6400, GE 635, UNIVAC 1108/1110, Honeywell 6000, IBM 370
- Operating System: OS Release 20 (IBM); SCOPE (CDC)
- Minimum Storage Required: 100K bytes
- Peripheral Equipment: Standard scratch disk plus permanent disk for war file

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation is available.

TIME REQUIREMENTS:

- 1 day to acquire and structure base data in model input format
- 10-30 seconds CPU time per model
- 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several times per year

USER: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Europe Division
The Pentagon
Washington, D. C. 20301
Telephone: OX-54347

KEYWORD LISTING: Analytical Model; Conventional War; Land Forces; Computerized; Two-Sided; Deterministic

TITLE: STAB II - Anti-Air Warfare Battle Model

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Development Center

PURPOSE: STAB II is a computerized, analytical general war model used to analyze the effectiveness of airborne weapon systems, including the aircraft, weapons control system, and weapons, against one or many airborne targets attacking ships or a task force. The primary focus of concern is the combat effectiveness of the system in fleet air defense environments. In addition, the model may be used to study the effects of command and control systems functions, ECM, aircraft performance, maintainability and reliability, threat variations, and reaction time on fleet air defense.

GENERAL DESCRIPTION: STAB II is a two-sided model having both deterministic and stochastic elements. It is capable of considering one interceptor or one target, if desired, and of aggregating up to the level of 10 groups of 6 resolvable targets per group or 10 groups of 64 unresolvable targets per group. Simulated time is treated on an event store basis. The Game Time: Real Time ratio is variable, depending upon the number of interceptors and targets being considered. Probability is the primary solution technique used.

INPUT:

- o Threat description
- o Aircraft performance: acceleration, fuel usage, etc.
- o Weapon system performance
- o Command and control logic

OUTPUT:

- o Computer printout stating times of initiation and completion of combat and interceptors against targets and the expected number of kills achieved.

MODEL LIMITATIONS:

- o Two types of target groups, two types of interceptors
- o 10 target groups: 6 resolvable targets per group and/or 64 unresolvable targets per group
- o 30 interceptors (Combat Air Patrol plus deck-launched interceptors)

HARDWARE:

- o Computer: CDC 6600
- o Minimum Storage Required: 40,000
- o Peripheral Equipment: Mass storage (disk)

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: FORTRAN extended reference manual

TIME REQUIREMENTS:

- o 0.5 months to prepare input
- o 5 minutes CPU time average per game
- o Less than 1 day to evaluate results of 1 game; varies with number of parametric variations in total evaluation of systems

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 25 times per year

USERS:

- o Principal: NAVAIR (AIR-503), CNO (OP-96)
- o Other: OSD, Systems Analysis; NADC is support of other projects

POINT OF CONTACT: Systems Analysis and Engineering Department
Naval Air Development Center
Warminster, Pennsylvania 18974
Telephone: Autovon 441-2595

MISCELLANEOUS: STAB II can be linked with the Weapon System Engagement (WSE) model where an analog simulation determines launch opportunities versus a threat and the Launch Acceptability Region (LAR) provides missile launch zones against selected targets. This data is punched on cards for input into STAB II.

KEYWORD LISTING: Analytical Model; Computerized; Two-Sided; General War; Aircraft; Deterministic

TITLE: STATE III- Simulation for Tank/Anti-Tank Evaluation

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: STATE III is a critical event, stochastic, land combat model for simulating armor/anti-armor engagements. The model may be run as a pure simulation without human intervention or it can be used in a wargaming mode with the progress of the battle displayed on a graphics device. STATE II is a damage assessment model which is used to analyze the effectiveness of various weapons mixes and/or tactics.

GENERAL DESCRIPTION: The STATE III model is a two-sided, stochastic, event oriented land combat assessment model for simulating armor-anti-armor engagements. Close air support, minefields, smoke, and artillery can also be simulated in the model. The activities simulated include movement, detection, firing, changing speed, terminal effects including suppression, smoke, visibility, and tactics. The desired tactics to be used by both sides are input in the form of an order set. The tactical orders used are of two basic types: those which define a movement or posture change, and those which are based upon conditions which occur stochastically within the model such as damage levels. Terrain, cover, concealment, and visibility are also simulated by the model.

INPUT: The following data are used as inputs to the model:

- Game control data
- Terrain boundaries
- Digitized landforms, vegetation and man-made obstacle elevations
- Group data which identifies the composition and starting location of the combat units. (A combat unit can consist of one or more individual weapons.)
- Weapon characteristics data
- Minefield locations
- Close air support data
- Artillery data
- Ordnance data
- Tactical orders
- Sensor data (for detection purposes)
- Hit and kill probability data

OUTPUT: The results of the simulation can be output in three ways:

- An event by event listing of each replication of the battle can be listed on a computer printout.
- A summary of the results of the several replications can be output in both tabular form and graphical form.
- In the interactive mode, the progress of the battle in terms of movement and kills can be observed in a series of graphical displays on a cathode ray tube device.

LIMITATIONS:

- Infantry (riflemen) is not simulated
- Model does not simulate attack helicopters at the present time
- Maximum of 60 individual combat units
- Maximum of 6 unit types
- Maximum of 3 weapon types per unit

HARDWARE:

- Computer: CDC 6400
- Operating System: SCOPE 3.4
- Minimum Storage Required: 105-120$_8$K according to scenario
- Peripheral Equipment: Disk and tape Tektronix 4002A (for interactive mode)

SOFTWARE:

- Programming Language: FORTRAN IV COMPASS
- Documentation: (1) STC TM-344 "Simulation for Tank/Anti-Tank Evaluation (STATE II) User's Guide," April 1973 (NU)
  (2) STC TM-324 "Simulation for Tank/Anti-Tank Evaluation (STATE II) Concept and Model Description," May 1972 (NU)
  (3) STC TM-422 "An Interactive Version of the STATE II Model," May 1974 (NU)

TIME REQUIREMENTS:

- Develop and code 5 x 8 km terrain area - 5 man-days
- Prepare input deck (including order set) - 4 hours
- CPU time for 30 replications - 2-5 hours
- Analysis of results - 1-3 man-days

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: SHAPE Technical Centre
IABM (FRG), RARDE (UK)
Martin-Marietta (USA)

POINT OF CONTACT: SHAPE Technical Centre
P. O. Box 174
The Hague
Netherlands
APO New York 09159

KEYWORD LISTING: Simulation; Monte Carlo; Critical Event; Tank Warfare; Anti-Tank Weapons; Land Combat; Stochastic; Effectiveness; Guided Missiles; Model; Direct Fire; Tactics; Interactive

TITLE: STRATEGEM - Strategic Relative Advantage Model

PROPONENT: Headquarters, Strategic Air Command (SAC/XPS)

DEVELOPER: XPSF, Headquarters, SAC

PURPOSE: STRATEGEM is a computerized, analytical model that determines the relative position of advantage after each of a possible series of limited nuclear exchanges. The model provides an anlytical tool for investigating the implications of a less-than-all-out nuclear exchange. The relative strategic position of both sides after each limited exchange and the remaining options for a subsequent exchange are assessed.

GENERAL DESCRIPTION: STRATEGEM is a two-sided, deterministic model involving land, air and sea forces. It is capable of considering an individual weapon against an individual target, if desired, and can aggregate both weapons and targets up to any level the user wishes. Expected values are the primary solution techniques used.

INPUT:

- o Fixed inputs: weapon yield, CEP, height of burst, target vulnerability, type of overpressure and adjustment factor for each target category and the minimum and maximum vulnerability (VNs) bounds for applications of each weapon type.
- o Scenario inputs: option to change yields, CEPs, and mini/max weapon VNs in fixed inputs, weapon system reliabilities and penetration rates, the number of targets per DGZ category, number of weapons by type, number of weapon carriers (limited to 4 bomber types, 12 land-launched missile types, and 4 sea-launched missile types), and the maximum number of weapons each target may receive.
- o Exchange inputs: identification of the side attacking and type of attack (suppression or objective), minimum acceptable damage expectancy for initial weapon consideration, minimum acceptable compounding DE for more than one weapon per target, maximum DE (i.e., upper bound cut-off for weapon allocation), determination of weapon allocation and target types (i.e., percent of weapons and percent of targets), target eligibility (i.e., a numerical value assigned each target category to predetermine the type of weapon: bomber, ICBM, or SLBM, which is to be used in the initial attack), target value, (i.e., subjective order in which targets are to be attacked), and attack timing sequence which may be bypassed, but could be used for sensitivity study on bomber regeneration after an attack.

OUTPUT: The output of numerical results, tabulated for each exchange, includes a current inventory of weapons and targets showing those remaining, used and destroyed. A final summary provides an inventory of weapon types remaining after each exchange and at the end of all exchanges.

MODEL LIMITATIONS:

- o Targets currently handled as point targets.
- o Maximum of 14 bomber weapon types
- o Maximum of 16 missile types (ICBMs: 12 for Blue, 12 for Red
  SLBMs: 4 for Blue, 4 for Red)
- o Range is not simulated.
- o FOOTPRINT is not simulated.
- o No geographical constraints are simulated.

HARDWARE:

- Computer: IBM 360/85
- Operating System: 360 OS
- Minimum Storage Required: 28,600 words

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation consists of a brief description of subroutines and their purpose. User's documentation is complete, in the form of a computer printout listing. Technical documentation is not complete.

TIME REQUIREMENTS:

- 1/3 month to acquire base data
- 3 man-days to structure data in model input format
- 1 minute CPU time per model cycle
- 2 days to 2 weeks learning time for users
- A few hours to analyze and evaluate results

SECURITY CLASSIFICATION: FOR OFFICIAL USE ONLY

FREQUENCY OF USE: 50 times per year

USER: XPSF, Headquarters, SAC

POINT OF CONTACT: *Headquarters, Strategic Air Command*
Directorate, Future Force Structure Studies and Evaluation (XPS)
Offutt Air Force Base, Nebraska 68113
Telephone: Autovon 271-4316

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic

TITLE: STRAT MESSAGE - Development of Strategic Command and Control Report-Back Methodology

PROPONENT: United States Air Force, Studies and Analysis (USAF/SA)

DEVELOPER: Air Force Studies and Analysis and Systems Control, Inc.

PURPOSE: This computerized analytical general war model simulates the two-way flow of multi-priority messages from the NCA to forces (e.g., SIOP execution messages) and from the forces back to commanders and the NCA (e.g., strike reports, launch reports, NUDET reports). The model determines the quantity and quality of information available to the NCA and commanders to assist them in decision-making in the trans- and post-attack phases of a general nuclear war.

GENERAL DESCRIPTION: STRAT MESSAGE is general in nature, such that either strategic or tactical C^3 networks can be examined. The model was primarily designed for strategic forces (bombers, SSBNs, ICBM Launch Control Centers) and uses a stochastic time-step Monte-Carlo technique with a shortest path network algorithm to determine probabilities of message receipt as a function of time at special nodes. A scenario of hours duration can be run in minutes of CPU time.

INPUT:

- Network topology (nodes and links)
- Link availabilities
- Node probabilities of survival
- Node processing times and link delays
- Node group data and queue lengths
- Message types
- Run parameters (number of Monte Carlo replications, game time, etc.)

OUTPUT:

- Computer printout which includes probability of message receipt as a function of time and the percent of time that messages arrive at each destination node.
- Detailed output at the end of each Monte Carlo cycle is available at the user's option. This data includes node dead times, node alive times, order of nodes receiving message, and message arrival times at each intermediate and destination node.

MODEL LIMITATIONS: Computer storage capability only.

HARDWARE:

- Type of Computer: GE-635
- Operating System: GECOS
- Minimum Storage Required: 100K storage cells (36 bits) for network of 30 nodes, 100 links, and 20 messages
- Peripheral Equipment: Discs can be used for input/output data storage.

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: User's Manual and Programmer's Manual available.

TIME REQUIREMENTS:

- o Time required to acquire base data and structure data in model input format varies from hours to days, depending on size and conplexity of network to be modeled.
- o CPU time per model cycle is less than 5 minutes for moderate-sized network.
- o Several weeks learning time for players.
- o Hours-days to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100-200 times per year

USERS:

- o Principal: AF/SASC
- o Other: NSA

POINT OF CONTACT: United States Air Force
Studies and Analysis and Systems Control
(Capt James Hengle)
The Pentagon, Room 1D431
Washington, D. C.
Telephone: OX-50547

MISCELLANEOUS: This model is linked to the Network Status Model (NSM), which computes link availabilities and node probabilities of kill for nuclear and electronic countermeasure environments which are used as input data. No intermediate data manipulation is required. The model is a follow-on to the Dynamic Network Simulator. A new upgrade to the NSM is being undertaken to include improvement in nuclear phenomenology and ECM techniques/simulations.

KEYWORD LISTING: Analysis; C^3; Message Flow Networks; Stochastic; Nuclear Exchange; Network Topology

TITLE: Super-Ace

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: To provide a capability to evaluate alternative strategic forces in terms of their effectiveness against specified target sets or their contribution to the strategic nuclear balance.

GENERAL DESCRIPTION: Super-Ace is a computerized, analytical deterministic model that provides a capability to compare various strategic forces either by measuring their effectiveness against specified target sets, through the use of a single strike optimum weapon allocator, or by measuring static characteristics such as throwweight, number of warheads, megatonnage, etc. The model is highly user oriented, thereby enabling the user to exercise control over the degree of output fidelity desired.

The capability exists to input either pre-stored arsenals and/or target sets or to create new ones. Additionally, weapon arsenals/target sets may be temporarily modified prior to production to facilitate sensitivity analysis or minimize set up time. The primary solution techniques used in weapon allocations are LaGrange multipliers, linear programming and probability.

INPUT:

- Weapon variables
- Target variables
- Scenario variables
- Allocation constraints
- Static measures desired
- Degree of output summarization desired

OUTPUT:

- Static measure summaries
- Throwweight drawdown
- Summaries in terms of weapon allocation and value destroyed
- Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- Geography is not explicitly considered
- Aggregated target data base
- Co-location not considered

HARDWARE:

- Computer: Honeywell
- Operating System: MULTICS
- Minimum Storage Required: N/A
- Peripheral Equipment: Interactive I/O device

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision.

TIME REQUIREMENTS:

- o 10-60 seconds CPU time for one strike allocation
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year

USERS: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D.C. 20301
Telephone: OX-55587

KEYWORD LISTING: Analytical Model; Strategic Forces; Computerized; Deterministic; Linear Programming

TITLE: TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability, Evaluation and Research

PROPONENT: United States Air Force, Studies Analysis (USAF/SA)

DEVELOPER: AF/SAG

PURPOSE: TAC AVENGER is a computerized, analytical model designed to evaluate the effectiveness of one aircraft versus another in a close-in air duel. The chief focus of concern is to evaluate the capabilities of two aircraft, opposing each other in a close-in air duel. During the duel, each aircraft can maneuver in three dimensions and launch weapons at the other aircraft. The kill probabilities of each firing pass are cumulative for the entire time of the air duel. Aircraft motion is computed by utilizing the standard aerodynamic equations of flight. As a result, an aircraft's actual aerodynamic maneuvering capability is simulated. Aerodynamic parametric variation may be exercised to determine the sensitivity of variables.

GENERAL DESCRIPTION: TAC AVENGER is a two-sided model having both deterministic and stochastic elements. It involves air forces only. It is primarily designed to consider two aircraft in an air duel, and is capable of aggregating up to thirty air duels lasting five minutes each. Aerodynamic equations of flight and probability theory are the primary solution techniques used.

INPUT:

- The aircraft description requires basic engineering data. Aerodynamic and structural capabilities defined by lift and drag curves, "G" limitations, visibility limitations, engine thrust, and fuel flow curves are necessary. The systems described include on-board sensors. Descriptions for missiles require complete definition of launch parameters, missile control, guidance and aerodynamic capabilities, and kill radius of warhead. Gun systems require complete ballistic information for the type of projectile under consideration, and gun and sight characteristics.

OUTPUT:

- Second-by-second summary of aircraft's position, maneuvers, gun and missile firings.
- Gun summary.
- Missile summary.
- Computer graphics.

MODEL LIMITATIONS:

- The model simulates the air duel of two opposing aircraft, each of which may employ as many as 12 tactical maneuvers with variations in each.

- Since the maneuver selection is stochastic, numerous duels are required to produce a usable data point.

HARDWARE:

- o Computer: Honeywell 635, Honeywell 6180
- o Operating System: GECOS III, Multics
- o Minimum Storage Required: 44k, 358 pages
- o Peripheral Equipment: 16 files

SOFTWARE:

- o Programming Language: FORTRAN IV
- o There is no documentation.

TIME REQUIREMENTS:

- o 1 month to structure data in model input format.
- o 4 minutes CPU time per model cycle.
- o 2 years learning time for users.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 20,000 times per year

USERS: AF/SAGF, HQ USAF

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff/Studies and Analysis
AF/SAA
The Lynn Building
1111 19th Street
Arlington, VA 22209
Telephone: OX-48573

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Air Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Time Step

TITLE: TACOS II (USACDC version)
TACOS II/AF2 (Air Force version)

PROPONENT: U.S. Army Air Defense School, Directorate of Combat Developments (TRADOC version)
USAF/SAGR and ADTC/XR (Air Force version)

DEVELOPER: U.S. Army Air Defense School, Directorate of Combat Developments USAMICOM, and BDM, Inc.

PURPOSE: The TACOS II and the TACOS II/AF2 versions of this model are computerized, analytical models designed to consider the effectiveness of ground/air defense and penetrating air forces accounting for air and ground damage, ordnance and missile stockage, command and control, ECM, etc. Both deal primarily with operational employment doctrine and concepts, and technical characteristics of the following: (1) force development, (2) deployments, (3) effectiveness, (4) weapons requirements, (5) command and control requirements, (6) doctrine development, (7) system parameters, and (8) ECM. In addition, the model considers organizational requirements, systems performance, and interface requirements for both ground and air forces.

GENERAL DESCRIPTION: Both TACOS II and TACOS II/AF2 are two-sided, stochastic models that simulate ground and air forces, using a digitized terrain model. Both versions are primarily designed to consider from 1 to 255 ground sites versus a large number of aircraft or ballistic missile. Ground sites may range in size from a single gun to a missile launch complex, while aircraft may be aggregated up to the level of a penetrator wave. The simulation covers a 24-hour period and a 1600 km2 area. Simulated time is treated on an event store basis. The primary solution techniques used are game theory, queuing theory, probability, Newton-Raphson, Monte Carlo, and radar theory equations.

INPUT: For TACOS II:

- o Ground system characteristics: e.g., reaction times, missile guidance parameters, radar power, damage criteria
- o Penetrator type characteristics: e.g., radar cross-section as a function of azimuth, elevation, radar frequency, jammer types, maneuver capability
- o Ground element characteristics: e.g., location, altitude, sector limits, ammunition (missile) stockage
- o Air element characteristics: e.g., flight profile, number in sortie, decoys, ARMS, ordnance

For TACOS II/AF2:

- o See "TACOS II, Input Variable Descriptions and Format, Fourth Edition," 1 November 1971, and BDM Memorandum, subject: Modifications to FRAG 3 (TACOS 2.4/AF1), 14 January 1972

OUTPUT: For TACOS II:

- o Complete time history of each engagement
- o Resources expended summaries by fire unit
- o Number of penetrators reaching objectives with summaries
- o Targets damaged by target type
- o Numbers of penetrators lost with summaries

For TACOS II/AF2:

- o Same as TACOS II plus detailed missile flyout parameters and probabilities of survival

MODEL LIMITATIONS:

- o Terrain limited to Germany, Korea, and Okinawa
- o 15AD system types
- o Cannot presently simulate aircraft interceptors, ground sites moving during battle, or moving support ECM aircraft
- o Maximum of 255 ground sites
- o Maximum of 2040 aircraft
- o Maximum of 255 threat paths

HARDWARE:

- o Computer: TACOS II - IBM 360/50, CDC 6500/6600
  TACOS II/AF2 - IBM S/360
- o Operating System: Both versions - OS/PCP/MFT/MVT; SCOPE
- o Minimum Storage Required: TACOS II - 300K bytes, IBM/155K Octal, CDC
  TACOS II/AF2 - 330K bytes
- o Peripheral Equipment: Both versions - one to two 2314 disk packs and/or one to two tape units, plus card reader and line printer or remote terminal to computer facility

SOFTWARE:

- o Programming Languages: Both versions - FORTRAN IV (H) and ALC
- o Documentation: TACOS II is fully documented.

TIME REQUIREMENTS: Time requirements for TACOS II are based on a full-scale run (i.e., 255 sites, 15 AD systems, 100+ threat paths, etc.); TACOS II/AF2 requirements involve, at most, 50 sites (usually 2 or 3) against few threat paths. CPU requirements for TACOS II are based on IBM 360/50 CPU rates.

- o To acquire base data: TACOS II - 1-3 man-months
  TACOS II/AF2 - 1/2 man-day to 1 month
- o To structure data in model input format: TACOS II - 1-2 man-months
  TACOS II/AF2 - 1 man-week
- o CPU time per model cycle: TACOS II - 1-10 hours
  TACOS II/AF2 - 30 seconds to 1 hour
- o To analyze and evaluate results: TACOS II - 1 man-day

SECURITY CLASSIFICATION: UNCLASSIFIED (both versions)

FREQUENCY OF USE: TACOS II (USACDC usage) - Run continually
TACOS II (Air Force version) - 25-50 times
AF/2 version - 1 time (this version dates from December 1976)

USERS: TACOS II;

- o Principal: TRADOC, Directorate of Combat Developments, USAADS
- o Other: U.S. Army Missile Command

TACOS II/AF2:

- o Principal: USAF/ADTC(XR), USAF/SAGR, USAF/SAGF

POINT OF CONTACT: TACOS II: U.S. Army Air Defense School (ATSA-CD-C5-C)
Fort Bliss, Texas 79916
Telephone: 915/568-6702
Autovon 978-6702

TACOS II/AF2: Headquarters
Armament Developments and Test Center
(ADTC/XR)
Eglin Air Force Base, Florida 32542
Telephone: 904/882-5845
Autovon 872-5845

MISCELLANEOUS:

- o TACOS II/AF2:
  - o TACOS supplies aircraft loss rates, ammunition, expenditure rates, etc.
  - o FAIRPASS provides gun aiming errors or Pk tables for TACOS.
  - o TACOS II/AF2 (developed in December 1976) supersedes TACOS II/AF1.

KEYWORD LISTING: Analytical Model; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: TACWAR - Tactical Warfare Model

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Institute for Defense Analyses

PURPOSE: TACWAR is used as a theater-level model and is designed to evaluate the relative effectiveness of opposing combat forces employing conventional, nuclear, and chemical weapons which can be delivered by ground and air means.

GENERAL DESCRIPTION: The TACWAR model is a fully-automated combat simulation that can be used to assess the interactions of combat forces employing conventional, nuclear and chemical weapons in a theater-wide campaign. Duration of the war game is set by the user and is measured in fixed 12-hour cycles. The program incorporates facilities that enable the user to model a specific geographical structure for the theater. This structure is then used as the foundation for seven simulations: air combat, target acquisition, nuclear combat, chemical combat, ground combat, theater control, and supplies transportation.

INPUT: The input files contain data which serve to structure the model theater of battle, to allocate and maneuver personnel and materiel, and to define the rules of the game. A working file is used to store time-t data from the input file MIT in a format which can be accepted by subroutine TIMET on appropriate days.

OUTPUT: Outputs produced by TACWAR consist of five kinds of printed listings, each of which is written to one or more output files. The outputs include:

- o An alphabetic listing of the blank common vaiables with their initial data values
- o Theater control initialized data
- o Records of selected inputs in tabular form
- o Detailed game reports
- o Summary game reports

MODEL LIMITATIONS:

- o TACWAR does not simulate a breakthrough type situation.
- o Logistics aspects of the model are very aggregated.

HARDWARE:

- o Computer: Honeywell 6080
- o Minimum Storage Required: 60K

SOFTWARE:

- o Programming Language: FORTRAN IV

TIME REQUIREMENTS: 6 to 30 CPU minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Expected 100 times per year

USER: OJCS/SAGA

POINT OF CONTACT: Studies, Analysis, and Gaming Agency
Organization of the Joint Chiefs of Staff
The Pentagon, Washington, D. C. 20301
Telephone: OX-57795

KEYWORD LISTING: Ground-Air Warfare; Nuclear Warfare; Chemical Warfare; Theater-Level Model; Ground Forces; Tactical Air Forces; Deterministic Computer Model

TITLE: TAGSEM - Tactical Air-to-Ground System Effectiveness Model

PROPONENT: Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio

DEVELOPER: Deputy for Development Planning (ASD/XR), A. T. Kearney, Caywood-Schiller Division; and University of Dayton Research Institute

PURPOSE: TAGSEM is a computerized analytical, damage assessment/weapons effectiveness model used to evaluate the relative effectiveness of prospective tactical air-to-ground systems. Systems evaluated ranged from manned and unmanned aircraft with their accompanying support aircraft, to standoff weapons and specific subsystems on each aircraft. Flights of aircraft, including support aircraft, are flown against opposing ground forces. TAGSEM assesses the damages imposed on the ground forces by each aircraft and in turn, the damage done to each aircraft by ground defenses as a function of time. The effectiveness of one specific system can be compared to the effectiveness of an alternative system. The model accounts for the synergistic effects of the support aircraft complementing the attack aircraft. Not only is TAGSEM used to compare the relative effectiveness of one specific system to another, but can be used to determine the relative force effectiveness due to the addition or replacement of alternate support aircraft or support systems.

GENERAL DESCRIPTION: TAGSEM is a two-sided, deterministic expected value model involving land and air forces. It is designed to consider a single aircraft attacking a single element in a target matrix. It can also consider a single aircraft to a flight of aircraft attacking from a single element to attacking several target matrices. The level for which TAGSEM was primarily designed considers a single flight of aircraft attacking a target matrix. The range of possible manipulation extends from a single flight of aircraft to several wings of different type aircraft attacking a single target matrix to attacking several target matrices of different composition. Simulated time is treated on an event store basis. The primary solution techniques are probability theory and the Laws of Physics.

INPUT:

- o Scenario description
- o Airframe/engine performance
- o Payload capabilities
- o One-on-one system survivability against anti-aircraft artillery and surface-to-air missiles
- o Navigation and target acquisition capabilities
- o Weapon lethalities (which include delivery accuracies)
- o Navigational accuracies
- o Sortie rate and target description

OUTPUT: Computer printout stating as a function of time (cycles) the expected values of targets killed, aircraft killed, weapons delivered, sorties flown, air defense sites killed. Levels of output vary from one-page summaries for the entire conflict to detailed summaries of each event that occurred.

MODEL LIMITATIONS:

- o No command and control network modeled
- o No air-to-air simulation
- o No ground-to-ground simulation

HARDWARE:

- o Computer: 6600 CDC
- o Operating System: NOS/BE
- o Minimum Storage Required: 150K octal
- o Peripheral Equipment: Printer, 6 scratch files

SOFTWARE:

- o Programming Language: FORTRAN IV Extended
- o Documentation: User's Manual and a methodology volume to be completed by September 1977

TIME REQUIREMENTS:

- o 2 months to acquire base data
- o 2 days to structure data in model input format
- o 1 to 3 minutes CPU time
- o 6 to 18 seconds CPU time per model cycle
- o 4 months learning time for players
- o 4 hours to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS:

- o Principal: Deputy for Development Planning
- o Other: USAF Tactical Fighter Weapons Center, Nellis AFB, Nebraska
  Naval Weapons Support Center, Crane, Indiana

POINT OF CONTACT: Mr. Timothy Ringler
Deputy for Development Planning (ASD/XROL)
Aeronautical Systems Division, AFSC
Wright-Patterson AFB, Ohio 45433

MISCELLANEOUS: There are five models which provide inputs for TAGSEM: (1) P001 - A one-on-one AAA model, (2) Various one-on-one SAM models, (3) TATAC - Tactical Target Acquisition, (4) Airframe/Engine Performance Model, and (5) Munition Lethality Models. TAGSEM supersedes the Target Engagement Model (TEM) and the Mission Effectiveness Model (MEM).

KEYWORD LISTING: Analytical Model; Computerized; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Two-Sided; Deterministic; Event Store

TITLE: TAM - Target Acquisition Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several targets. The latest developments have been done in-house.

PURPOSE: The Target Acquisition Model is a computerized model used for analysis. It provides a list of acquired targets for use by artillery simulation models.

GENERAL DESCRIPTION: The Target Acquisition Model is a one-sided, stochastic model involving sensor systems only. The model is designed to consider theater sensor systems, with no limit on the number of sensor systems employed. Simulated time is treated on an event store basis. Probability is the primary solution technique used combined with algorithms for computer simulation.

INPUT:

- o Target Array
- o Sensor detection probabilities
- o Type and number of sensors

OUTPUT: Target lists and data appropriate to each target

MODEL LIMITATIONS: Model is limited to providing target lists as needed by ammunition rates methodology.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader, printer, card punch, and disk storage

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Target Acquisition Model, December 1974, USACAA Available in Defense Documentation Center
- o The above represents complete user's documentation and technical documentation.

TIME REQUIREMENTS:

- o Approximately 4 months to acquire base data
- o 1 man-month to structure data in model input format
- o 1 minute CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED when separated from code sheet

FREQUENCY OF USE: 3 times per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS: The Target Acquisition Model supplies input for the Blue and the Red Artillery Models of the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Computerized; One-Sided; Stochastic; Event Store

TITLE: Tank

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: To provide the capability to evaluate the contribution of airborne tankers to strategic bomber force capability and to all strategic forces in general.

GENERAL DESCRIPTION: Tank is a computerized, analytical deterministic model that provides the capability to evaluatethe contribution of tankers to strategic bomber force capability as measured by the percent of target value destroyed by the bomber force. Additionally, the model can be used to compare various force mixes of bombers, weapons and tankers on a force effectiveness basis.

The model is highly user oriented, thereby enabling the user to exercise control over the degree of output fidelity desired. Temporary modifications to pre-stored data are easily accomplished facilitating rapid sensitivity analysis. The primary solution techniques used in bomber/weapon allocation are LaGrange multipliers, linear programming and probability.

INPUT:

- o Number and type of tankers
- o Number and type of bombers
- o Number of weapons for bombers
- o Percent of tankers/bombers available for allocation
- o Variables for specifying tanker/bomber flight profiles and performance characteristics
- o Probability of bomber penetration
- o Variables controlling degree of output desired

OUTPUT:

- o Summarization of variable selected
- o Listing of strategies used in weapon allocation
- o Summaries of weapon allocation and value destroyed by bomber type and entry point area
- o Numbers of bombers, weapons and tankers used, by type
- o Output options allow a detailed description of the weapon allocation or aggregated summaries

MODEL LIMITATIONS:

- o Aggregated target data base
- o Aggregated weapon type

HARDWARE:

- o Computer: Honeywell
- o Operating System: MULTICS
- o Minimum Storage Required: N/A
- o Peripheral Equipment: Interactive I/O device

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision.

TIME REQUIREMENTS:

- o 10-60 seconds CPU time for one strike allocation
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year.

USERS: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washingtion, D. C. 20301
Telephone: OX-55587

KEYWORD LISTING: Analytical Model; Strategic Tanker/Bomber; Computerized; Deterministic; Linear Programming

TITLE: TARTARUS IV N/COCO

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Strategy and Tactics Analysis Group (STAG)

PURPOSE: TARTARUS IV N/COCO is a computerized, analytical model designed to simulate movement and attrition of ground forces in contact. Externally derived effects of close air support and nuclear weapons can be applied in the model, if desired.

GENERAL DESCRIPTION: TARTARUS IV N/COCO is a two-sided, deterministic model involving land forces only. It is primarily designed to consider units ranging in size from a battalion to a division theater (300 units). Simulated time is treated on a time step basis. The primary solution technique used is the numerical solution of a system of differential equations based on Lanchester's Linear Law.

INPUT:

- Terrain data
- Unit descriptions: mission, location, and strength in FPP (Firepower Potential)
- Factors for weapon class versus weapon class effectiveness, attrition, movement, suppression
- Air strike data
- Fuel and ammunition distribution and consumption factors
- Individual weapon FPPs

OUTPUT:

- Unit Status Report
- Detailed Strength and Loss Report
- Ammunition and Fuel Expenditure Reports
- CALCOMP plots of terrain, strikes, unit locations, objectives, and frontages
- All of the above are optional, except the Unit Status Report

MODEL LIMITATIONS: Limited number of units simulated.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 56K words
- Peripheral Equipment: 1 tape drive, FASTRAND format mass storage, CALCOMP plotter is optional

SOFTWARE:

- Programming Languages: FORTRAN V, 1108 Assembly Language
- Documentation: "TARTARUS IV N/COCO Players and Technical Manual." (AD 829 525L)
- Technical documentation is complete; user's documentation is not. The model has been modified since the above documentation was published and corrections have not been published.

TIME REQUIREMENTS:

- o 4 months to acquire base data
- o 2 man-months to structure data in model input format
- o Average of 1/2 hour's CPU time per model cycle (4 hours real time)
- o 1 week learning time for users
- o 2 months to analyze and evaluate results of one study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 studies

USERS: USA STAG, USA CAA

POINT OF CONTACT: MS. P. M. Fleming
US Army Concepts Analysis Agency, MRM
8120 Woodmont Avenue
Bethesda, Maryalnd 20014
Telephone: 202/295-1630

MISCELLANEOUS: TARTARUS IV N/COCO supersedes all previous versions of TARTARUS.

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Computerized; Two-Sided; Deterministic; Time-Step

TITLE: TATS - Tank/Antitank Simulation

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments were done in-house.

PURPOSE: The Tank/Antitank Simulation is a computerized model used for analysis. It simulates tank battles between battalion-sized units or smaller. It has the capability of incorporating all antitank weapons. The model is primarily concerned with the expenditure of ammunition, armor losses, and concurrent weapon losses for both Red and Blue sides. Many items can be extracted from the model, such as battle duration, loss rate, ammunition lost in combat, and so forth.

GENERAL DESCRIPTION: The Tank/Antitank Simulation is a two-sided, deterministic model involving land forces only. In theory, there are no logical limits to the model, but it is generally applied to units no smaller than a platoon. Simulated time is treated on a time step basis. The model is expected value, hence it uses probability theory as appropriate but is primarily a computer simulation algorithm.

INPUT:

- Weapon kill probabilities
- Specific number and kind of armor units
- Detection limits
- Target priorities
- Firing rates

OUTPUT:

- Ammunition expenditures and armor losses at up to six points during a battle
- Printout of sub-results for up to six ranges between antagonists, and a summary

MODEL LIMITATIONS:

- Limited to a linear battle which can be approximated by a single axis
- Can readily accept different weapons but cannot readily accept variations in target sensing devices

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 32K
- Peripheral Equipment: Disk storage and card punch, reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Tank/Antitank Model, December 1974, USACAA. Available in Defense Documentation Center
- The above represents complete user's documentation. Technical documentation is complete.

TIME REQUIREMENTS:

- 2 months to acquire base data
- 2 man-weeks to structure data in model input format
- Approximately 1 minute CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED when separated from code sheet. Otherwise, SECRET.

FREQUENCY OF USE: 300 times per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

MISCELLANEOUS:

- The Tank/Antitank Simulation provides input to the Theater Rates Model of the Ammunition Rates Methodology.
- The Tank/Antitank Simulation supersedes the FILTER Model.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: TLS - Training Line Simulator

PROPONENT: Air Force Human Resources Laboratory, Personnel and Manpower Systems Branch, Occupational and Manpower Research Division (AFHRL/ORS)

DEVELOPER: Decision System Associates, Inc.

PURPOSE: The Training Line Simulator is a computerized, analytical model that games the interaction of policy decisions impacting on Basic Military Training and Entry-level Technical Training. The model assesses policy alternatives with respect to training school prerequisites, weekly requirements mix, wash-out, wash-ahead and wash-back rates, application of fill priorities and desirable prerequisites to selected assignments, etc. In addition, it investigates the effects of changing the quality of enlisted input with respect to fulfilling training objectives.

GENERAL DESCRIPTION: The Training Line Simulator is a one-sided model having both deterministic and stochastic elements. Only Air Force personnel are considered, consisting of the weekly input of non-prior service enlisted personnel into the Air Force. Simulated time is treated on a weekly time step basis. The primary solution technique is a modified Ford-Fulkerson optimal assignment algorithm.

INPUT:

- o Mandatory and desirable prerequisites for each Technical Training course
- o Weekly quotas for each course
- o Wash-out, wash-ahead and wash-back policies, optimal classload, etc., for Basic Military Training and for each training course
- o Records of hypothetical Air Force enlisted input

OUTPUT:

- o Weekly summary of number of inductees, number in Basic Military Training and in Technical schools, graduates from BMT and Tech schools, wash-backs, wash-aheads, wash-outs, casual pools, etc.
- o Output tape of airman records with disposition codes, etc.

MODEL LIMITATIONS:

- o Maximum of 4,000 inductees per week
- o 255 weeks
- o 250 individual training courses

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Standard
- o Minimum Storage Required: 44K words (36 bits/word) plus operating system
- o Peripheral Equipment: 2 tape drives, 6 mass storage files (approximately 229K words depending on application), card reader, printer

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation: Training Line Simulator (Enhanced Version)
  AFHRL-TR-73-50(I) User's Manual
  AFHRL-TR-73-50(II) Training Line Simulator (Enhanced Version)

TIME REQUIREMENTS:

- o 1 week to 3 months to acquire and structure base data, depending upon the specific application
- o 1-15 seconds CPU time per model cycle
- o Less than 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Monthly

USERS:

- o Principal: AFHRL/ORS, Personnel and Manpower Systems Branch
- o Other: Personnel Processing Group, Lackland Air Force Base
  HQ Air Training Command
  DCS/P USAF

POINT OF CONTACT: Air Force Human Resources Laboratory
Personnel and Manpower Systems Branch
Occupational and Manpower Research Division (AFHRL/ORS)
Brooks AFB, Texas 78235
Telephone: Autovon 240-3222

MISCELLANEOUS: N/A

KEYWORD LISTING: Analytical Model; Air Forces; Computerized; One-Sided; Mixed Deterministic/Stochastic; Time Step

TITLE: TOPOPS - Total Objective Plan for the Officer Procurement System

PROPONENT: Air Force Human Resources Laboratory, Personnel and Manpower Systems Branch, Occupational and Manpower Research Division (AFHRL/ORS)

DEVELOPER: System Automation Corporation

PURPOSE: TOPOPS is a computerized optimization model to allow the analysis of various officer procurement scenarios for planning purposes.

GENERAL DESCRIPTION: TOPOPS is an aggregate optimization model that uses a linear programming algorithm to program a scheme of officer procurement to either minimize cost or maximize quality. Constraints on optimization include production requirements by officer type (pilot, navigator, etc.), policy restrictions, specific characteristics of various commissioning sources and training programs (including attrition rates, type crossflows, and career turnover). The model works on a five-year procurement lead time to optimize a five-year schedule of accessions.

INPUT: Inputs into the model are flexibly arranged to allow different procurement scenarios to be examined by modifying both the objective function and the constraint set by choosing particular members of classes of available constraints and objective functions. Numerical data inputs include such things as procurement requirements by officer type for the next five years; turnover rates by type of officer and training agency; training agency crossflow rates; maximum production limits for training agencies; limitations on supply pools of officers; quality distributions of various supply pools; inflation rates; and training agency and commissioning source costs, capacities, and attrition rates.

OUTPUT: Model output includes a schedule of officer recruitment requirements to meet the accession requirements by type, supply pool, and commissioning source for the next five years. Also, the model gives a program cost analysis and officer quality profile, and a sensitivity and parametric analysis of the objective function and constraint set.

MODEL LIMITATIONS: The model is currently limited by the linear programming algorithm available to 8200 contraints and 6100 structural variables. This allows only twenty officer types, twenty commissioning sources, twenty supply pools, ten procuring years, and a five-year procurement scenario to be considered.

HARDWARE: The TOPOPS model was designed and programmed to run on the UNIVAC 1108.

SOFTWARE: The UNIVAC FMPS linear programming package is called by the source program to perform the optimization routines. The model itself has three distinct modules: the Data Initializer Module, the Flow Module, and the Report Processor Module. The first translates the user-specified problem definition into specifications for the linear programming algorithm. The second module inputs the matrix entries of the initial tableau until it locates an optimal solution, if one exists. The third module writes user-oriented reports.

TIME REQUIREMENTS:

- 1 week to prepare data for input
- 5 minutes of CPU time to run (depending on size of specified problem)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- AFHRL for development
- HQ USAF/DPPPO

POINT OF CONTACT: Air Force Human Resources Laboratory
Personnel and Manpower Systems Branch
Occupational and Manpower Research Division (AFHRL/ORS)
Brooks AFB, Texas 78235
Telephone: Autovon 240-3222

MISCELLANEOUS: N/A

KEYWORD LISTING: Analysis and Planning; Personnel Procurement; Computerized; Optimization; Deterministic; Simultaneous Solution

TITLE: TRANSMO - Transportation Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: TRANSMO is a computerized, analytical, logistics model whose purpose is to determine the arrival time of U.S. Forces in overseas theaters of operations. The model determines deployment schedules with specified lift assets, or designs a lift system to meet the required deployment schedule. In addition, it is also concerned with designing force structures to meet objective requirements.

GENERAL DESCRIPTION: TRANSMO is a one-sided, deterministic model. It is designed to consider units ranging from a division to a design group of multiple theater operations. Simulated time is treated on a time step basis.

INPUT:

- o Force characteristics: troop strengths, location, readiness state, resupply, consumption, etc.
- o Lift vehicle characteristics: speed, load and unload times, capacity for each cargo type, etc.
- o General characteristics: port restrictions, distances between ports, attrition factors, etc.

OUTPUT: Detailed and summary printouts showing deployment schedules and/or lift and force structure.

MODEL LIMITATIONS: Resolution of model inputs

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 50K

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: None
- o Both user's documentation and technical documentation are being developed

TIME REQUIREMENTS:

- o 1/4 month to acquire base data
- o 1/2 man-month to structure data in model input format
- o 1/4 hour CPU time per model cycle
- o 1/4 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS:

- o Principal: CAA for ODCSOPS
- o Other: Engineer Strategic Studies Group

POINT OF CONTACT: Mr. E. J. Rose
US Army Concepts Analysis Agency, MRM
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1630

MISCELLANEOUS: PFD provides unit closures to the ATLAS model. It may also receive unit requirements from ATLAS.

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Computerized; One-Sided; Deterministic; Time Step

TITLE: TRM - Theater Rates Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The Theater Rates Model is a computerized model used for analysis. It simulates theater level combat over a predetermined span of time.

GENERAL DESCRIPTION: The Theater Rates Model is a two-sided deterministic model. It simulates theater level conflict on a day by day basis in order to determine ammunition expenditures of all Army weapons engaged in conflict. Its primary solution technique is that of a computer simulation algorithm.

INPUT:

- Personnel casualties and armor losses from all forms of combat
- Red and Blue force deployment schedule
- Scenario of combat activity

OUTPUT:

- Computer printout of day by day ammunition expenditures
- Status of both Red and Blue forces in the theater

MODEL LIMITATIONS:

- Combat activity is dictated by a scenario
- Blue and Red deployed units are aggregated

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 21K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Theater Rates Model, December 1974, USACAA Available in Defense Documentation Center
- Preceding publication represents complete user's and technical documentation.

TIME REQUIREMENTS:

- Approximately 1 month to acquire basic data
- 1 week to structure data in model input format
- 1 minute CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 times per year

USER: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (WGR)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1696

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Theater Level Conflict; Two-Sided; Deterministic

TITLE: TXM - Tank Exchange Model

PROPONENT: *US Army Concepts Analysis Agency (USACAA)*

DEVELOPER: Institute for Defense Analysis (IDA)

PURPOSE: TXM is a manual, analytical, damage assessment/weapons effectiveness model which allows measurement of the effectiveness of tank/antitank weapons systems in the areas of firepower and vulnerability and to a lesser extent, the effects of battlefield mobility and RAM-D. The model is used in the US Army Concepts Analysis Agency to compare effectiveness of M60A1E3 to M60A1; and XM1 to M60A1E3 tanks.

GENERAL DESCRIPTION: *TXM is a two-sided, stochastic model* involving land forces and was designed primarily for individual tank/antitank systems. The model can play up to 20 defenders, unlimited number of attackers in groups not greater than 10. TXM was designed for platoon/company level with a range from tank sections to battalions. Simulated time is treated on a time step/event store combination. It is a fast running model, 400 iterations of 60 minute battle in 25 minutes. The model uses a multitude of probability formulae including probabilities of hits, kill given hits, detonation, misfire and breakdown.

INPUT:

- o Terrain analysis (cover, concealment)
- o Probabilities of hit under the following constraints - range, target speed, fire speed, amount of target evasiveness, direction of evasion, target aspect
- o Probabilities of kill given a hit for each 4-inch square presented by the target vehicle

OUTPUT:

- o Printout averaging number of shots/hits/kills by range
- o Averages of battle outcome
- o Ranges of detection for all firer-target pairs
- o Model can report range, aspect, and result of each shot; analysis of hits in terms of target aspect and number of feet from aim point.
- o Coding is such that any other processed data which may be of interest in a specific study is easily obtainable

MODEL LIMITATIONS:

Weapon system interaction is limited to two types of defenders (2 types of ammo each) and one type of attack (3 types of ammo)

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC 8
- o Minimum Storage Required: 64K

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Institute for Defense Analysis, "The Tank Exchange Model," 3 volumes, 1973. USACAA, "TXM," annotated program listing

TIME REQUIREMENTS:

- o 2 months required to acquire data base
- o 2 man-months to structure data in model input format
- o CPU time depends on number of iterations, e.g., 6 minutes for 100 reps
- o 2 months learning time for players
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 1 study a year; 10-15 production runs per study

USERS:

- o Principal: US Army Concepts Analysis Agency
- o Other: TRASANA
  Institute for Defense Analysis
  The BDM Corporation

POINT OF CONTACT: Major W. J. McGrath
US Army Concepts Analysis Agency (SMS)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1526

MISCELLANEOUS: N/A

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Computerized; Two-sided; Stochastic; Time Step; Event Store

TITLE: UNICORN - Conventional/Nuclear Weapon Allocator Model

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: UNICORN is a conventional/nuclear weapon allocator that addresses those kinds of issues revolving around the employment capabilities of a conventional/nuclear arsenal against a snapshot target array, which may consist of fixed targets or operating areas of troop units. The target array can be of arbitrary size, ranging from division or less through theater. Weapons can be any conventional or nuclear indirect fire weapons, ranging from tactical through strategic. The model optimally allocates weapons of varying characteristics against targets of various types. Each weapon and target location can be explicitly defined, and the weapon-target range considered in determining weapon impact error estimates. The model can allocate both nuclear and conventional weapons as a function of range, survivability estimates, weapon effectiveness, target acquisition capability, and various constraints. For nuclear attack, either a radiation or a blast criteria may be specified. The user has the option of specifying an upper limit for blast and radiation levels. In addition to the damage limitation consideration, the model can guarantee a least cost allocation which achieves user specified levels of firepower and mobility damage. User specified levels of target damage in a number of user-defined target categories can also be guaranteed. A weapon effectiveness drawdown can be readily determined, including optimal weapon deployment. The program also considers the effects of rate of fire limitations caused by weapons sytems rates of fire, target acquisition, tactical and strategic C^3, and weapon survivability estimates.

GENERAL DESCRIPTION: The model uses generalized linear programming to efficiently enumerate all of the possible assignments of weapons to targets. The method of solution is an iterative process, with a small number of possible assignments considered at each step. The best subset of assignments at each step is chosen by a linear program. The process ends when no new assignments can be made or when the potential improvement in the objective function value falls below a specified level. The objective function is a sum of values from concave nonlinear functions, each reflecting the expected damage of the particular weapon-target combination.

INPUT:

- Scenario variables
- Weapon variables
- Target variables
- Collateral radiation and blast restriction variables
- Weapon and target hedge variables
- Force design constraint variables
- Optimal deployment variables

OUTPUT:

- Summaries in terms of the weapon allocation and targets and value destroyed
- Extensive summary of input data
- Output options allow detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- o The model is basically one-sided, and considers estimates of opponent responses rather than dynamically calculating which might happen over time.
- o Expected value calculations are generally performed.
- o Targets defined in the target array structure are considered to be independent.
- o A flat-earth calculator is used to compute weapon to target ranges.
- o Direct fire attrition to troop units is not considered.

HARDWARE:

- o Computer: GE/Honeywell 645, IBM 370/145, Honeywell 6080, IBM 360
- o Operating System: MULTICS (MIT), CT67 (IBM)
- o Minimum Storage Required: Honeywell-71K bytes, IBM-284K bytes
- o Peripheral Equipment: Standard scratch disk plus permanent disk

SOFTWARE:

- o Porgramming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision. Documentation is updated periodically.

TIME REQUIREMENTS:

- o 1 day or less to acquire and structure base data in model input format
- o 10-60 seconds CPU time
- o 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year

USERS:

- o Principal: OASD(PA&E)
- o Other: CIA, CCTC

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: OX-59180

KEYWORD LISTING: Analytical Model; Theater War; Land Forces; Air Forces; Sea Forces; Computerized; Linear Programming; Nuclear Weapons

TITLE: UNREP - Underway Replenishment Model

PROPONENT: Chief of Naval Operations, OP-964

DEVELOPER: MATHTECH, Inc.

PURPOSE: UNREP is a computerized, analytical, logistics model used to determine the size and global distribution of the Navy's fleet of underway replenishment ships. The model's chief focus of concern is to determine cost-effective underway replenishment groups (URGs) which are able to support a naval task force at the theater level.

GENERAL DESCRIPTION: This one-sided deterministic model deals with sea forces only. UNREP was primarily designed to consider Naval Task Groups. Each task group may consist of one to ten different ship types, with one to nine ships of each type. UNREP also considers Naval Task Forces. A task force may be specified as a combination of one to ten task group types with one to nine groups of each type. Simulated time is treated on a time step basis. The primary solution technique used is network analysis.

INPUT:

- Task force composition
- Tempo of operations
- Distance from resupply point and the number of on-station unrep ships

OUTPUT:

- Computer printout listing various feasible mixes of unrep ships which can meet calculated requirements
- Feasible solutions are ranked according to life-cycle cost.
- There are 11 output reports available which provide the user with various levels of detailed and summary information.

MODEL LIMITATIONS:

- The model requires that an input task force be resupplied from a single base.
- The model's fixed data base currently contains capacity and consumption figures for two types of fuel and bulk ordnance.
- No data is included for other products, e.g., missiles, provisions and stores.

HARDWARE:

- Computer: Current operating on IBM 370/168
- Operating System: VOS
- Minimum Storage Required: 64K
- Peripheral Equipment: Features are available for interactive use.

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Complete model documentation with sample input and output is available.
- o Both user's documentation and technical documentation are complete.

TIME REQUIREMENTS:

- o 2 man-weeks to acquire base data
- o 1 man-week to structure data in model input format
- o 5 minutes CPU time per model cycle
- o 1 hour to analyze and evaluate results

SECURITY CLASSIFICATION: Up to CONFIDENTIAL, depending on version

FREQUENCY OF USE: Annually

USERS:

- o Principal: OPNAV
- o Other: Naval Postgraduate School
  Naval War College

POINT OF CONTACT: Chief of Naval Operations, OP-964C
Room 4A538
The Pentagon
Washington, D. C. 20350
Telephone: 202/697-5675

KEYWCRD LISTING: Computerized; Analytical; Logistics; One-Sided; Deterministic; Sea Forces; Time Step

TITLE: VALIMAR

PROPONENT: Organization of the Joint Chiefs of Staff; J-5/Studies, Analysis, and Gaming Agency

DEVELOPER: Defense Communications Agency, Command and Control Technical Center and The Lambda Corporation

PURPOSE: VALIMAR is a computerized, analytic model designed to assess the damage effected by the offensive forces of each of two opposing sides attacking, successively, the target base of the others. In so doing, the model addresses the problem of allocation of weapons to targets.

GENERAL DESCRIPTION: VALIMAR is a highly aggregated, expected value, nuclear exchange model designed to evaluate the destructive capability of two strategic forces. This is accomplished by selecting a subgrouping of the targets as "preferred" targets, then constructing an allocation to achieve a specified fraction of damage on this subgrouping. The allocation itself uses lagrange multipliers to achieve maximum real buy (difference between target value destroyed and weapon value expended).

INPUT: Target characteristics, weapon characteristics (yield, CEP, HOB, survival expectancy, vulnerability and penetration expectancy) and attack strategies (optional).

OUTPUT: Consists primarily of computer printout, reporting on both input items and results of the scenario, specifically, data base input can be checked in two formats, one of which permits an easy comparison of different data bases. As to reporting scenario results, a target destruction summary is produced as well as target-by-target breakdowns and a brief allocation summary. In addition, customized reports may be generated, from input and results, according to user-designed formats.

MODEL LIMITATIONS:

- A maximum of 48 weapons and 150 target classes
- Individual target and weapon units are not identified (they are aggregated).
- Time, geography, and physical movement are not simulated.

HARDWARE:

- Computer: HIS 6000
- Operating System: GCOS
- Minimum Storage Required: 50K
- Peripheral Equipment: 540 links of disc storage

SOFTWARE:

- Programming Language: FORTRAN and CMAP
- Documentation: Users Manual, TM94-75, available from Commander, CCTC, C313, The Pentagon, Washington, D. C.

TIME REQUIREMENTS:

- Prepare Data Base: 5 hours
- CPU Time: 15 minutes
- Analyze Output: 10 hours

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 600 times per year

USERS: Organization of the Joint Chiefs of Staff, J-5 and Studies, Analysis, and Gaming Agency

POINT OF CONTACT: Command and Control Technical Center
C313
The Pentagon
Washington, D. C. 20301
Telephone: OX-50258

MISCELLANEOUS: Portions of VALIMAR's data base consist of data which is related to vulnerability of targets. These numbers can be calculated by the integrated response parameter system (IRS). The model is under examination for new allocation methodologies.

KEYWORD LISTING: Aggregated; Lagrange; Allocator; Damage Assessment; Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic

TITLE: VECTOR-I - A Theater Battle Model

PROPONENT: Command and Control Technical Center, Defense Communications Agency (CCTC/DCA)

DEVELOPER: Vector Research, Incorporated

PURPOSE: VECTOR-1 is a computerized, analytical, midintensity, non-nuclear warfare model developed for use in estimating net assessments, performing force deployment studies and generating information for performing trade offs among weapon systems. The outcome of force interactions is determined in terms of FEBA movement and the attritions of personnel and individual weapon systems.

GENERAL DESCRIPTION: The VECTOR-1 model is a two-sided deterministic simulation of integrated land and air combat. The level of aggregation is the maneuver battalion or its equivalent. It is a theater-level model, but may be applied without modification to corps-level model or corps-level engagements. Employing small time steps, modified differential equations of combat are used to compute dynamically the outcome of attacks involving maneuver battalions. Other model activities are performed using larger time steps, e.g., one day. Tactical decision rules supplied by the user provide for flexibility in controlling model decision processes. Ten different types of maneuver battalions or the equivalent may be played for each side. Each side may employ nine types of maneuver unit weapon systems and seven types of tactical aircraft, as well as artillery, mines, helicopters, air defense artillery systems and aircraft shelters.

INPUT:

- Initial forces and supply inventories, and a schedule of weapon, personnel and supply arrivals in the theaters.
- Basic weapons performance data (not aggregated into a form such as firepower scores).
- Geographic and terrain data
- Tactical decision rules

OUTPUT: Daily and cumulative casualties and weapon system losses, by type, are provided, and supply consumption data are given by type of supply. Current inventories of weapons, personnel and supplies are also listed. All of these data are given for individual battalions (if applicable), and are also presented as sector (corps) and theater totals. Reserve forces are explicitly accounted for. Numbers of sorties flown on each mission are given for each aircraft type. The daily activity of each battalion is shown, along with its daily FEBA position. Attributions of casualties and weapon system losses to the enemy system type which inflicted the attrition are presented.

MODEL LIMITATIONS: The model is limited to specific maximum numbers of unit types, weapon system types and geographic sectors. Memory sizes of the computers which were expected to be used were considered in establishing the limitations.

HARDWARE: The model has been successfully exercised on IBM 370.168, UNIVAC 1108 and H6080 computers. The minimum storage requirement is approximately 50K (decimal). Peripheral equipment requirements include disk pack and tape.

SOFTWARE:

- o Programming Language: ANSI Fortran
- o Documentation: WSEG Report 251, VECTOR-1
  WSEG Report 260, Preprocessor for VECTOR-1
- o The above documents constitute complete user's and technical documentation.

TIME REQUIREMENTS: An estimated six man-months are required to acquire base data and structure it in model input format. This time can be reduced considerably for other than the initial utilization of the model, since few changes to much of the data (e.g., basic weapon system performance data) would be expected for subsequent studies. Also, a data preprocessor is available which provides an interface with the automated OSD data file described in NATO Task Force Action Memorandum 3 (NTFAM-3), allowing model users with access to this file to reduce substantially the required data preparation time. For typical games, the model requires approximately 11 seconds CPU time per combat day. The time required to analyze and evaluate results is dependent upon the range and depth of the analysis; however, the level of detail available in the output facilitates efficient analysis and evaluation.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Since the model is newly developed, it has not as yet been used operationally.

USERS: Anticipated users include SAGA, US Army Concepts Analysis Agency, and Institute for Defense Analyses

POINT OF CONTACT: Command and Control Technical Center
C315
The Pentagon
Washington, D. C. 20301
Telephone: OX-53521

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: VGATES II

PROPONENT: Department of the Army, Deputy Chief of Staff for Operations and Plans

DEVELOPER: General Research Corporation

PURPOSE: VGATES II is a computerized, analytic, general war model. It represents the ground, air and sea combat operations with associated mobility forces for Blue force deployments, over a specified period of time beginning at M-day and proceeding through D+180. The primary problem addressed is the evaluation of allied forces in the European Theater in 1982; secondary problem involves the Korean Theater.

GENERAL DESCRIPTION: VGATES II is a two-sided, deterministic model involving land, air and sea forces. It was designed to consider US and NATO division type slices, air squadrons, submarines, escorts, etc., and its possible manipulation range is up to 15 distinct Blue force types and 10 distinct Red force types, including airlift and sealift. The model was designed primarily for US and NATO; USSR and Pact; Europe and Pacific; Chinese and Korean forces; virtually any set of forces for any conventional theater. The model has deterministic features using the time step basis. The primary solution technique is automated iterative calibration to results from models of higher resolution, followed by iterative application of Lanchester type attrition equations (square law).

INPUT

- Force level and FEBA location observations at 30-day calibration points (or 30 cycle intervals)
- Force interrelationships (which forces attrit which opposing forces)
- Actual force deployments or availabilities for movement to the theater

OUTPUT:

- FEBA trace over time
- Force levels (or losses) over time
- Optional probabilities describing FEBA location
- Interactive user query of up to 118 data items per cycle
- Interactive graphic display of FEBA chart, loss reports, and force level reports

MODEL LIMITATIONS:

- Forces must usually be aggregated into potential units
- Observations must be provided for calibration at 30-cycle intervals
- FEBA is represented at an averaged point for each cycle

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 28K
- Peripheral Equipment: Graphic display (optional)
  Plotter (optional)

SOFTWARE:

- o Programming Language: FORTRAN, UNIGRASP
- o Documentation: METOFOR Volumes

TIME REQUIREMENTS:

- o 1 month required to acquire base data
- o 1/4 man-months to structure data in model input format
- o Less than 1 second CPU time per model cycle
- o 1/2 months learning time, if any
- o 1/2 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 30 times per year

USERS:

- o Principal: USACAA
- o Other: None

POINT OF CONTACT: US Army Concepts Analysis Agency, JFJ
(Mr. Frank McKie)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 202/295-1646

MISCELLANEOUS:

- o VGATES II linked to Force Determination Model in the METOFOR system. This is not a required link.
- o Force Determination Model provides force variations input to VGATES II for evaluation in the METOFOR system.
- o Model supersedes VGATES
- o No new capabilities are planned for this model.

KEYWORD LISTING: Analytic; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: VONSIM-AUTOVON Simulation

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: The BDM Corporation

PURPOSE: This model was developed to assess AUTOVON system performance as it relates to the support of critical command and control communications during periods of both benign and stressed operating environments. Transient/permanent component upset and functional impairment of network assets due to EMP illumination are addressed in detail.

GENERAL DESCRIPTION: The AUTOVON system simulation is a dynamic, event stepped digital computer model employing both deterministic and stochastic solution techniques. All message traffic is discretely modeled on a call-by-call basis. C^2 call interdependencies are permitted including message aggregation, alternate destinations and dependency chains. Network switching centers are modeled at a functional level whereby calls are processed through distinct operational classes where each class typically requires a unique type of switch resource. All logical processes performed by the switches are represented in detail which accommodates variations in hardware/software/procedures among the switches. Temporal/spacial variations in EMP illuminations are translated into functional impairments, including call dropping and misrouting, switch and link outages, increased processing time and erroneous induced service requests.

INPUT:

- Network configuration (number and type of switches, interconnectivity, multi-homed subscribers of interest)
- Representative traffic sample of day-to-day operations
- Attack scenario (time and location of bursts)
- Casual message scenario (C^2 traffic)
- Control parameters

OUTPUT: A file of all events processed by the simulation is generated to provide for complete flexibility in game outcome recapitulation and analysis.

- The main game itself provides aggregate satistics of performance for the C^2 and routine traffic classes such as blocking probabilities and speed of service.
- A summary of the processing of each distinct C^2 call is available.
- The set of C^2 calls can be sorted into various subclasses dependent on user needs.
- Specific point-to-point performance statistics can be generated.

MODEL LIMITATIONS:

- Addresses only EMP caused impairments, although other types can be treated parametrically.
- Routing procedures are limited to those currently employed by AUTOVON. (All routing logic is contained in a replaceable submodel.)

HARDWARE:

- o Computer: CDC 6000-7000 systems
- o Operating System: SCOPE
- o Storage Required: 120-150K Octal
- o Peripheral Equipment: Disk storage for five files and one tape drive

SOFTWARE: Programming language is CSC FORTRAN IV extended

TIME REQUIREMENTS:

- o Data Base: The network configuration is provided by AT&T on magnetic tape from which the VONSIM data base is generated in one three-minute computer run. No experience is available for other networks.
- o Burst and message scenarios can require from one to eight man-weeks of effort depending on size, complexity and starting point.
- o The model executes at 2-2 1/2 times real time for busy hour traffic loads.
- o Run preparation including input of control parameters requires one half to one hour.
- o Rigorous run analysis is typically done in less than a day.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: On a continuing basis in support of DNA ongoing EMP testing and analysis.

USERS: The BDM Corporation for DNA.

POINT OF CONTACT: Mr. J. P. Riceman
Mr. R. H. Schmidt
The BDM Corporation
1920 Aline Avenue
Vienna, VA 22180
Telephone: 703/893-0750

KEYWORD LISTING: Digital Computer Simulation; Electromagnetic Pulse; Communications Analysis; Network Analysis; AUTOVON

AD-A050 320 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON D C F/G 15/7
CATALOG OF WAR GAMING AND MILITARY SIMULATION MODELS (7TH EDITI--ETC(U)
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TITLE: WASGRAM - War-at-Sea Graphical Analysis Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Johns Hopkins Applied Physics Laboratory and Strategic Analysis Support Group

PURPOSE: WASGRAM is an interactive, computer-assisted graphics model used for both analysis and training. It is designed to simulate carrier task group operations in a multi-threat environment.

GENERAL DESCRIPTION: WASGRAM is an interactive, time-step dynamic simulation. The model considers friendly carriers, surface ships, submarines, VP aircraft, VS aircraft, AEW aircraft, helicopters, interceptors, attack aircraft and enemy surface ships, submarines, and air raids on an individual basis with a maximum of approximately 1,000 units interacting together. Simulated time is treated on a selectable time-step basis. The ratio of game time to real time is approximately 1:5 if the maximum number of units is used. The primary solution technique is kinematic with probabilistic assessment of interactions between RED and BLUE forces.

INPUT:

- Unit positions
- Detection ranges and probabilities
- Enemy air, surface and subsurface tracks
- Weapon types and characteristics
- Various probabilistic assessment factors
- Communications and radar jamming factors

OUTPUT:

- Event by event chronology
- Engagement summary
- Damage assessment

MODEL LIMITATIONS:

- 1,000 units
- Because the game is interactive, the time to complete a single replication will depend directly on the number of units and the game's scenario.

HARDWARE:

- Computer: IBM 360/91, 370/158
- Operating System: Time sharing option
- Minimum Storage Required: 500K
- Peripheral Equipment: TEKTRONIX 4015 Graphics display terminal, hard copy device

SOFTWARE:

- Programming Language: PL/1
- Documentation: "An Introduction to the War-at-Sea Graphical Analysis Model (WASGRAM)," APL/JHU/PAG No. 62-75, CNO/OP-96-CM-3300, October 1975 (Version II to be published late 1977)

TIME REQUIREMENTS:

- 4 man-days to prepare input
- 2 hours per 15 game hours playing time
- Approximately 30 seconds CPU time per model cycle
- 16 hours training time for players
- 4 hours to analyze and evaluate results

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Used extensively by OP-604 for CVTG Gaming to support SIOP/RISOP Studies (Analysis)

USERS:

- Principal: OP-604 (Analysis)
  US Naval Academy (Training)

POINT OF CONTACT: Mr. Thomas P. Modelski
Mr. Jen-yih Wang
Planning Analysis Group
Johns Hopkins Applied Physics Laboratory
Laurel, Maryland 20810
Telephone: 953-7100

KEYWORD LISTING: Analytical; Training; General War; Limited War; Air Forces; Sea Forces; Computer Assisted; Deterministic; Time-Step; Graphics; War-at-Sea

LIST OF MODELS BY PROPONENT

Assistant Secretary of Defense, Program Analysis and Evaluation

AEM HEDGE - Arsenal Exchange Model
HALL
SSA - Static Sector Analysis Model
SUPER-ACE
TANK
UNICORN - Conventional/Nuclear Weapon Allocator

Organization of the Joint Chiefs of Staff, Logistics Directorate (J-4)

Aircraft Loader Model
BUILDUP
GFE-III - Gross Feasibility Estimator
MACE - Military Airlift Capability Estimator
POSTURE - Posture System
RAPIDSIM - Rapid Intertheater Deployment Simulator
SITAP - Simulator for Transportation Analysis and Planning

Organization of the Joint Chiefs of Staff, Studies, Analysis, and Gaming Agency (SAGA)

FORDIM - Force Distribution Model
IDAGAM II - IDA Ground Air Model
SATAN III - Simulation for Assessment of Tactical Nuclear Weapons
SNAP - Strategic Nuclear Attack Planning System
QUICK - Quick-Reacting General War Gaming System
TACWAR - Tactical Warfare Model

Headquarters, US Army, Office of the Comptroller

FCIS - Force Cost Information System

Headquarters, US Army, Deputy Chief of Staff for Logistics

SIGMALOG I - Simulation and Gaming Methods for Analysis of Logistics
SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics

Headquarters, US Army, Deputy Chief of Staff for Operations and Plans

FORDET - Force Determination Model
VGATES II

US Army Missile Command

MABS - Mixed Air Battle Simulation

US Army Ballistic Missile Defense Program Office

ANSR - Analysis of Safeguard Repertoire
SLATEM - Submarine Launch Assignment Targeting and Effectiveness

LIST OF MODELS BY PROPONENT
(Cont'd)

US Army Logistics Center

- AMPS - Air Movement Planning System
- LDB - Logistics Data Base
- MAWLOGS - Models of the Army Worldwide Logistics System
- MESM - Multiechelon Supply Model
- PLOM - Prescribed Load Optimization Model
- SPSM - Supply Point Simulation Model

US Army Combined Arms Combat Developments Activity

- Battalion Level Differential Model
- Combined Arms Combat Activity Jiffy War Game
- DIVWAG - Division War Game Model
- DYNTACS-X - Dynamic Tactical Simulator - Extended
- IEM - Helicopter Individual Engagement Model
- SEM - Helicopter Sortie Effectiveness Model

US Army Concepts Analysis Agency

- AMMORATES - Ammunition Rates
- ATLAS - A Tactical, Logistical and Air Simulation
- BAM - Blue Artillery Model
- CAM - Artillery Casualty Assessment Model
- CAMP - Computer Assisted Match Program
- CARMONETTE VI - Computer Simulation of Small Unit Combat
- CEM - Concepts Evaluation Model
- COMMEL II.5 - Integrated Tactical and Communications Simulation
- CONTACA
- FASTALS - Force Analysis of Theater Administration and Logistics Support
- FORECAST II
- FOREWON - Automated Force Planning System
- HOVARM - Anti-Armor Helicopter Combat Model
- HOVER - Anti-Personnel Helicopter Combat Model
- ICM - Infantry Combat Model
- NUFAM - Nuclear Fire Planning and Assessment Model
- NUREX - Nuclear Requirements Extrapolator
- RAM - Red Artillery Model
- SMOBSMOD - Strategic Mobility Simulation Model
- TAM - Target Acquisition Model
- TARTARUS IV N/COCO
- TATS - Tank/Anti-Tank Simulation
- TRANSMO - Transportation Model
- TRM - Theater Rates Model
- TXM - Tank Exchange Model

US Army Materiel Development and Readiness Command

- AFSM - Artillery Force Simulation Model
- AMSWAG - Army Materiel Systems Analysis Activity Wargame
- DIVLEV - Division Level Wargame Model
- EVADE II

LIST OF MODELS BY PROPONENT
(Cont'd)

US Army Air Defense School

- CADENS IV - CONUS Air Defense Engagement Simulator
- DADENS-C^2 - Divisional Air Defense Engagement Simulation - Command and Control
- TACOS II

US Army Materiel Systems Analysis Activity

- AESOPS

US Army Signal School

- SIMCE - Simulation - Communications - Electronics

US Army Academy of Health Sciences

- Hospital Model
- PFM - Patient Flow Model
- PWM - Patient Workload Model

Chief of Naval Operations, OP-95

- APAIR - ASW Program Air Engagement Model
- APSUB MOD 2 - ASW Program Submarine Engagement Model
- APSURF MOD I - ASW Program Surface Ship Engagement Model
- APSURV - ASW Program Surveillance Model
- SIM II

Chief of Naval Operations, OP-96

- ASGRAM - Anti-Submarine Graphical Resource Allocation Model
- ASWAS - ASW Air Systems Model
- CAM-SAAB - Countering Anti-Ship Missiles - Simulated Air-to-Air Battle
- CAM/SAM - Countering Anti-Ship Missiles - Surface-to-Air Missile Submodel
- CREST - Computer Routine for Evaluation of Simulated Tactics
- LOTRAK II - ASW Localization Model
- Mine Hunting Model
- SAMEM - Sustained Attrition
- SEALIFT
- WASGRAM - War-at-Sea Graphical Analysis Model

Chief of Naval Operations, OP-604

- Force Mix Model
- FOZ - Footprints by Oz
- NEMO III - Nuclear Exchange Model, Mod III

Chief of Naval Operations, OP-964

- UNREP - Underway Replenishment Model

LIST OF MODELS BY PROPONENT
(Cont'd)

Naval Air Systems Command

Aircraft Station Keeping Model
C-BASE II - Carrier-Based Air Systems Evaluation Model
ESCAP/6
STAB II - Anti-Air Warfare Battle Model

Military Sealift Command

PROFORMA - Pre-Voyage Performance Analysis
REACT - Requirements Evaluated Against Cargo Transportation
SEACOP - Strategic Sealift Contingency Planning System

Headquarters, United States Air Force, Assistant Chief of Staff, Studies and Analysis

ALM - Airlift Loading Model
COLLIDE - An Aggregated Conversion Model for Air Combat
STRAT MESSAGE - Development of Strategic Command and Control Report-Back Methodology
TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability, Evaluation and Research

Military Airlift Command

MACRO MODEL 12

Strategic Air Command

OASIS - Operational Analysis Strategic Interactions Simulation
STRATEGEM - Strategic Relative Advantage Model

United States Air Force Human Resources Laboratory

CAROM - Career Rotation Model
TLS - Training Line Simulator
TOPOPS - Total Objective Plan for the Officer Procurement System

United States Air Force Systems Command, Aeronautical Systems Division

TAGSEM - Tactical Air-to-Ground System Effectiveness Model

Aerospace Defense Command, NORAD

Interceptor War Game Model
RADOBS - Radar Observation System

SHAPE Technical Center

AGTM - Air and Ground Theatre Model
COMO III - Computer Modelling System for Air Defence Applications
NEWAIR
STATE III - Simulation for Tank/Anti-Tank Evaluation

LIST OF MODELS BY PROPONENT
(Cont'd)

Defense Communications Agency, Command and Control Technical Center

LULEJIAN-I
SIDAC - Single Integrated Damage Analysis Capability
VALIMAR
VECTOR-I - A Theater Battle Model

Defense Intelligence Agency

NDAM - Nuclear Damage Assessment Model

Defense Nuclear Agency

ATR - Air Transportation of Radiation
COMBAT II
DACOMP - Damage Assessment Computer Program
DCAPS - Dual Criteria Aimpoint Selection Program
INCAM - Integrated Nuclear-Communications Assessment Model
NUCROM - Nuclear Rainout Model
SEER III - Simplified Estimation of Exposure to Radiation
VONSIM - AUTOVON Simulation

Defense Civil Preparedness Agency

DASH III - Computerized System for Performing Detailed Assessments of the Hazards of Nuclear Attack

United States Arms Control and Disarmament Agency

SIRNEM - Strategic International Relations Nuclear Exchange Model

General Services Administration, Federal Preparedness Agency

AGM - Attack Generator Model
INFERS - Interindustry National Feasible Economic Recovery System
REACT Model
READY Model
RISK II

LIST OF MODELS BY DEVELOPER

Assistant Secretary of Defense, Program Analysis and Evaluation

SSA - Static Sector Analysis

Organization of the Joint Chiefs of Staff, Studies, Analysis, and Gaming Agency

FORDIM - Force Distribution Model

US Army Concepts Analysis Agency

AMMORATES - Ammunition Rates
BAM - Blue Artillery Model
CAM - Artillery Casualty Assessment Model
CAMP - Computer Assisted Match Program
COMMEL II.5 - Integrated Tactical and Communications Simulation
CONTACA
FORECAST II
HOVARM - Anti-Armor Helicopter Combat Model
HOVER - Anti-Personnel Helicopter Combat Model
ICM - Infantry Combat Model
NUFAM - Nuclear Fire Planning and Assessment Model
NUREX - Nuclear Requirements Extrapolator
RAM - Red Artillery Model
SMOBSMOD - Strategic Mobility Simulation Model
TAM - Target Acquisition Model
TARTARUS IV - TARTARUS IV N/COCO
TATS - Tank/Anti-tank Simulation
TRM - Theater Rates Model
TRANSMO - Transportation Model
TXM - Tank Exchange Model

US Army Logistics Center

AMPS - Air Movement Planning System
PFM - Patient Flow Model
PWM - Patient Workload Model

US Army Air Defense School

CADEN IV - CONUS Air Defense Engagement Simulator

US Army Academy of Health Sciences

Hospital Model

US Army Combined Arms Combat Developments Activity

Combined Arms Combat Developments Activity Jiffy Wargame
IEM - Helicopter Individual Engagement Model
SEM - Helicopter Sortie Effectiveness Model

LIST OF MODELS BY DEVELOPER
(Cont'd)

US Army Management Systems Support Agency

FCIS - Force Cost Information System

US Army Materiel Systems Analysis Activity

AESOPS
AFSM - Artillery Force Simulation Model
AMSWAG - Army Materiel Systems Analysis Activity Wargame
DIVLEV - Division Level Wargame Model
EVADE II

Chief of Naval Operations (OP-604)

Force Mix Model

Chief of Naval Operations (OP-964)

UNREP - Underway Replenishment Model

Center for Naval Analyses

CAM-SAAB - Countering Anti-Ship Missiles - Simulated Air-to-Air Battle
CAM/SAM - Countering Anti-Ship Missiles - Surface-to-Air Missile Submodel
SEALIFT

Naval Air Systems Command

Aircraft Station Keeping Model
C-BASE II - Carrier-Based Air Systems Evaluation Model
ESCAP/6

Naval Surface Weapons Center

Mine Hunting Model
PROFORMA - Pre-Voyage Performance Analysis
SAMEM - Sustained Attrition

Naval Command Systems Support Activity

NEMO III - Nuclear Exchange Model
REACT - Requirements Evaluated Against Cargo Transportation

Naval Air Development Center

STAB II - Anti-Air Warfare Battle Model

Naval Regional Data Automation Center

SEACOP - Strategic Sealift Contingency Planning System

LIST OF MODELS BY DEVELOPER
(Cont'd)

Naval Weapons Laboratory

APSUB MOD 2 - ASW Program Submarine Engagement Model

Headquarters, United States Air Force, Assistant Chief of Staff, Studies and Analysis

ALM - Airlift Loading Model
COLLIDE - An Aggregated Conversion Model for Air Combat
STRAT MESSAGE - Development of Strategic Command and Control Report-Back Methodology
TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability, Evaluation and Research

Strategic Air Command

STRATEGEM - Strategic Relative Advantage Model

Aerospace Defense Command, NORAD

Interceptor - Interceptor War Game Model
RADOBS - Radar Observation System

United States Air Force Systems Command, Aerospace Systems Division

TAGSEM - Tactical Air-to-Ground System Effectiveness Model

Military Airlift Command

MACE - Military Airlift Capability Estimator
MACRO MODEL 12

Defense Communications Agency, Command and Control Technical Center

GFE-III - Gross Feasibility Estimator
QUICK - Quick-Reacting General War Gaming System
SIDAC - Single Integrated Damage Assessment Capability
SNAP - Strategic Nuclear Attack Planning System

Defense Intelligence Agency

NDAM - Nuclear Damage Assessment Model

General Services Administration, Federal Preparedness Agency

AGM - Attack Generator Model
INFERS - Interindustry National Feasible Economic Recovery System
REACT Model
READY Model
RISK II

LIST OF MODELS BY DEVELOPER
(Cont'd)

Academy for Interscience Methodology

FOZ - Footprints by Oz
SIRNEM - Strategic International Relations Nuclear Exchange Model

Anagram Corporation

SATAN III - Simulation for Assessment of Tactical Nuclear Weapons

Applied Physics Laboratory, Johns Hopkins University

ASGRAM - Anti-Submarine Graphical Resource Allocation Model
ASWAS - ASW Air Systems Model
CREST - Computer Routine for Evaluation of Simulated Tactics
LOTRAK II - ASW Localization Model
WASGRAM - War-at-Sea Graphical Analysis Model

The BDM Corporation

COMBAT II
DADENS-C^2 - Divisional Air Defense Engagement Simulation - Command and Control
INCAM - Integrated Nuclear-Communications Assessment Model
TACOS II
VONSIM - AUTOVON Simulation

Booz-Allen Applied Research, Inc.

SIMCE - Simulation - Communications - Electronics

Computer Sciences Corporation

DIVWAG - Division War Game Model
LDB - Logistics Data Base
SITAP - Simulator for Transportation Analysis and Planning

General Research Corporation

ATLAS - A Tactical Logistical and Air Simulation
BUILDUP
CARMONETTE VI - Computer Simulation of Small Unit Combat
CEM - Concepts Evaluation Model
FASTALS - Force Analysis of Theater Administration and Logistics Support
FORDET - Force Determination Model
FOREWON - Automated Force Planning System
MAWLOGS - Models of the Army Worldwide Logistics System
MESM - Multiechelon Supply Model
PLOM - Prescribed Load Optimization Model
POSTURE - Posture System
RAPIDSIM - Rapid Intertheater Deployment Simulator

LIST OF MODELS BY DEVELOPER
(Cont'd)

General Research Corporation (Cont'd)

SIGMALOG I - Simulation and Gaming Methods for Analysis of Logistics
SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics
SPSM - Supply Point Simulation Model
VGATES II

General Dynamics Corporation

SIM II

Decision System Associates, Inc.

CAROM - Career Rotation Model
TLS - Training Line Simulator

Institute for Defense Analyses

Aircraft Loader Model
IDAGAM II - IDA Ground Air Model
TACWAR - Tactical Warfare Model

J. D. Kettelle Corporation

APAIR - ASW Program Air Engagement Model
APSURF MOD I - ASW Program Surface Ship Engagement Model

Lambda Corporation

VALIMAR

Lulejian and Associates, Inc.

LULEJIAN-I

Science Applications, Inc.

AEM HEDGE - Arsenal Exchange Model
ATR - Air Transportation of Radiation
DCAPS - Dual Criteria Aimpoint Selection Program
HALL
OASIS - Operational Analysis Strategic Interactions Simulation
SUPER-ACE
TANK
UNICORN - Conventional/Nuclear Weapon Allocator

SHAPE Technical Center

AGTM - Air and Ground Theatre Model
COMO III - Computer Modelling System for Air Defence Applications
NEWAIR
STATE III - Simulation for Tank/Anti-Tank Evaluation

LIST OF MODELS BY DEVELOPER
(Cont'd)

Stanford Research Institute

- ANSR - Analysis of Safeguard Repertoire
- DACOMP - Damage Assessment Computer Program
- MABS - Mixed Air Battle Simulation
- NUCROM - Nuclear Rainout Model
- SEER III - Simplified Estimation of Exposure to Radiation
- SLATEM - Submarine Launch Assignment Targeting and Effectiveness

System Automation Corporation

- TOPOPS - Total Objective Plan for the Officer Procurement System

Systems Research Group, Ohio State University

- DYNTACS-X - Dynamic Tactical Simulator - Extended

System Sciences, Inc.

- DASH III - Computerized System for Performing Detailed Assessments of The Hazards of Nuclear Attack

Tetra-Tech, Inc.

- APSURV - ASW Program Surveillance Model

Vector Research, Inc.

- Battalion Level Differential Model
- VECTOR-I - A Theater Battle Model

INDEX OF MODELS BY LONG TITLE

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INDEX OF MODELS BY LONG TITLE

DATA COLLECTION SHEET

TITLE: (Acronym followed by full name)

PROPONENT: (Organization primarily responsible for maintaining model)

DEVELOPER: (Organization/Corporation which developed current version of the model)

PURPOSE: (Analysis/Training) (Manual/computerized/computer assisted) (general or limited war/politico-military/logistics/damage assessment)

(This section should contain a brief narrative covering the above, the role the model plays and the primary and secondary problem the model addresses.)

GENERAL DESCRIPTION: (One/two sided), (Deterministic/stochastic/mixed), (Time step/event store), (Land/Air/Sea/Paramilitary/Civilian/etc.)

(This section is a brief narrative covering the above, level of unit/personnel/equipment/target aggregation, level of exercise, ratio of game time to real time and primary solution techniques.)

INPUT: (For example, scenario, weapons characteristics, troop unit size, arrival dates)

OUTPUT: (Computer printout, plots, raw data, statistically analyzed data)

MODEL LIMITATIONS: (e.g., number of targets, no geography)

HARDWARE:

- Type Computer:
- Operating System:
- Minimum Storage Required:
- Peripheral Equipment:

SOFTWARE:

- o Programming Language:
- o Documentation Identification:
- o Documentation Availability: (Include DDC accession numbers if assigned)

TIME REQUIREMENTS:

- o Prepare Data Base:
- o CPU Time per Cycle:
- o Data Output Analysis:

SECURITY CLASSIFICATION: (Model less data)

FREQUENCY OF USE: (e.g., 50 times per year/once a month)

USERS: (List primary organizations which have or are using the model)

POINT OF CONTACT: (List organization, address, and telephone number from which additional information can be obtained. Office symbols where applicable should be included.)

MISCELLANEOUS: (Supercessions, planned enhancements, linkage of this model to other models, etc.)

KEYWORD LISTING: (String of single words appropriate for indexing the model in an automated system, e.g., computerized, analytical, nuclear, damage-assessment, missiles, strategic)

NOTES:

(1) The data on a single model should be capable of being typed on two pages of 55 lines per page, 80 spaces per line.
(2) Data contained in this summary must be UNCLASSIFIED.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This catalog contains a brief description of 139 military simulations and models which are in general use throughout the Department of Defense. The models and simulations are categorized as to application. All models are listed alphabetically and are indexed by short title, long title, proponent, and developer. The description for each model includes: proponent, developer, purpose, general description, input, output, limitations, hardware, software, time requirements, security classification, frequency of

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(20 continued)

use, users, and point of contact for additional information. The inclusion of a specific model in the catalog was at the discretion of its proponent, and thus does not in any way constitute indorsement of the model by the Organization of the Joint Chiefs of Staff.